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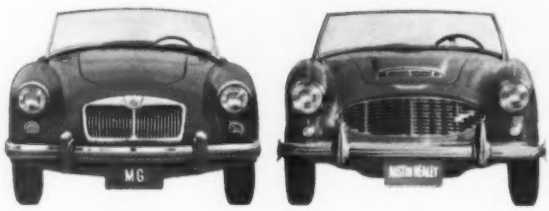

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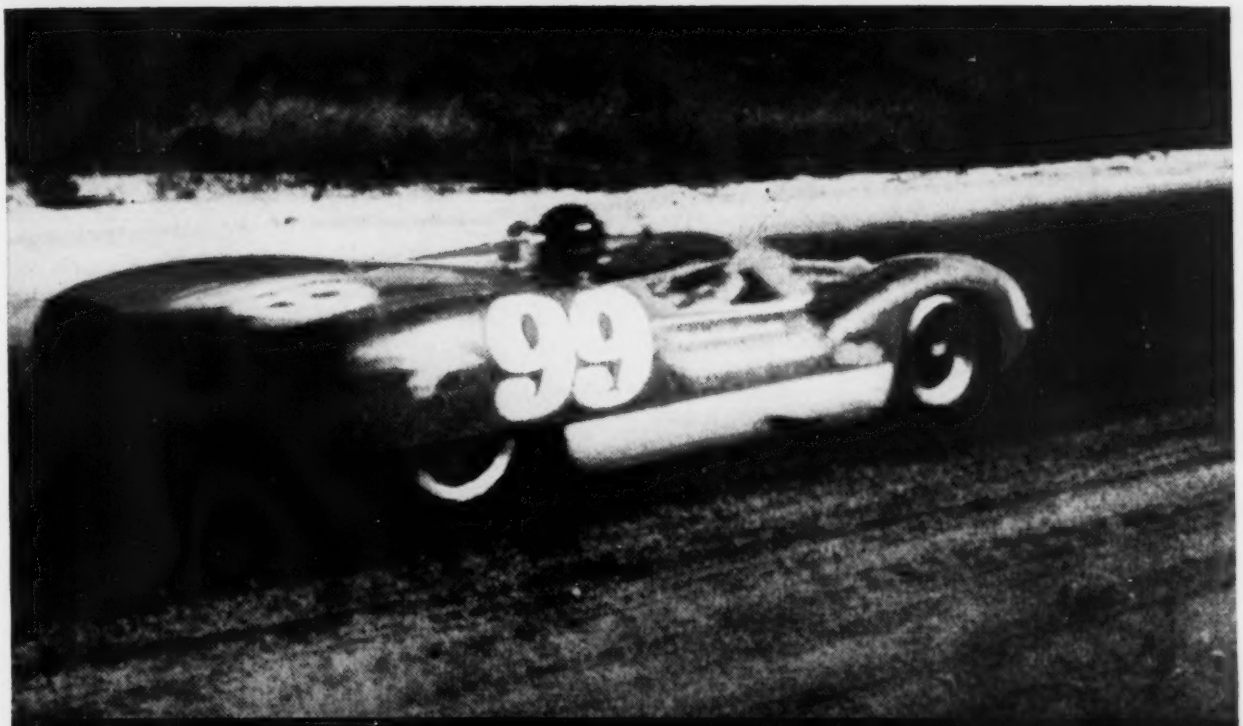

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OBSERVATION AND OPINION

DEBT TO BRITAIN — Would you own or want to own a sports car if the cheapest one on the market were priced at $3195? For most of us that would effectively rule out the excitement of this finest form of travel. More expensive sports cars would still be sold to a limited market, but there'd be no national network of sports car clubs, no rallying and racing on the scale we know it, no CAR AND DRIVER magazine to serve the interests of sports car owners.

That's exactly what would happen without the contribution of British industry. With the exception of the little Fiat 1200 Spider, which is a fun car but not really a sports car, no other country manufactures a sports chassis to sell below that figure. What's below it? All the staple sports machines – Healey Sprite, MGA, Sunbeam Alpine, Triumph TR3A, Morgan Plus 4 and Healey 3000. We'd certainly be lost without these!

TRADITION AND ABILITY — There must be a reason why no other country competes in this demanding but rewarding market. It's odd but Germany, France and Italy – all steeped in motor-sporting traditions and enthusiasm – since the war have never demanded or responded to home production of the low-priced sports car. In spite of her weather, which all natives will admit is miserable and hardly suited to top-down driving, England builds and buys open two-seaters in world-beating quantities.

No more reason than this is needed to devote a whole section of CAR AND DRIVER to British products, with the emphasis on the sporting side. I'd like to draw your special attention to the full Road Test of the Lotus XIX, which is conclusively the fastest-accelerating sports car we've ever tested. There are also three first-time technical unveilings: 1. The story behind the design of MG's 250-mph streamliner; 2. An inside look at Triumph's twin-cam engine, used for racing today but perhaps for production tomorrow, and 3. One of the best-kept secrets of the racing world, the untold story of Stirling Moss Mark III.

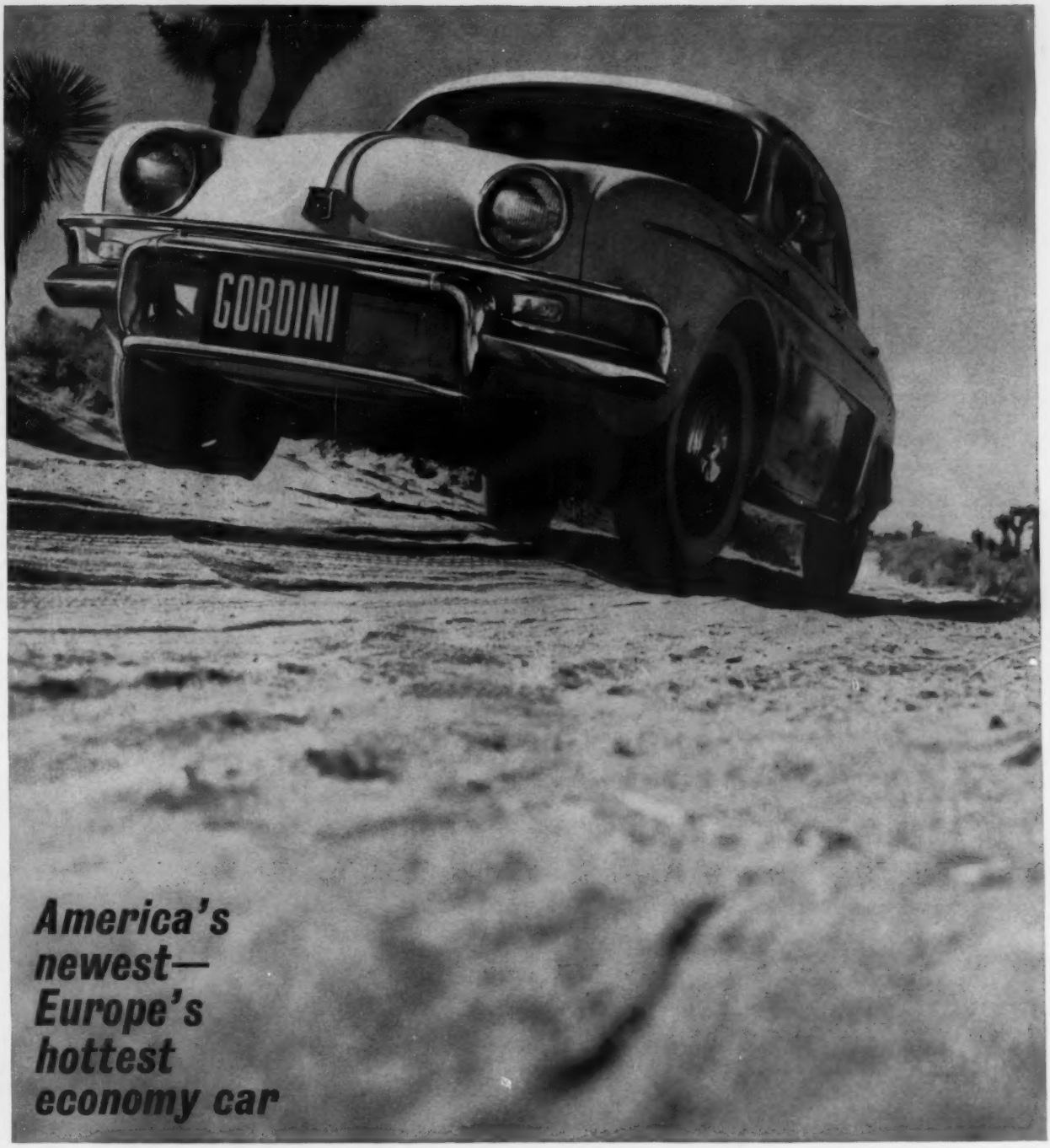
That striking lead photo on the British Cars and Drivers section shows Graham Hill in a Lotus G.P. car on the banking of the Avus circuit in West Berlin. Jesse Alexander shot it in the 1959 season.

LIFE'S WORK CONTINUED — Many of you have written to inquire about the health of Project Time Machine. As you see this month it's still in fine fettle as is its creator, Griff Borgeson. Griff became embroiled in the exciting Bonneville season last year, then undertook a major book project for Simon & Schuster in another area – see his "Man and Sex", just published. Since then we've been forcing a lot of chores on him, like storming around in the MG K3 Magnette and Lotus XIX, and he's only recently been able to get back to the Millers.

One of the two ex-Duray front-drivers is now appropriately reposing in the excellent Indianapolis Speedway Museum, where it will be restored and displayed – hence the timing of this latest installment just before the 1961 "500". The other Miller is still torn apart and its engine is on the point of receiving expert attention that we hope will revive "the unique scream of almost-dollar-sized pistons pumping at 8000 rpm, trains of spur-cut gears howling and blower impellers winding out to 40,000 rpm." For a good look at this sophisticated Tinker toy by Harry Miller see the cutaway in this issue. More technical stories, on the blowers, on the front drive, on the restoration, are in the making.

CUNNINGHAMISMS — Before leaving for Sebring I took a look at the production line version of the Type 63 Maserati, which is a much-changed car from the unpainted monster we showed in the April C/D. Its radiator, dashboard, front suspension and frame have all been refined during prototype testing. This was Cunningham's car, which is to be joined by another Type 63 and, hopefully, a new Type 61 for Le Mans. No XKE Jaguars this year, unfortunately, since they won't yet be able to qualify as Grand Touring cars. After Le Mans two Type 63s will probably be raced on the SCCA circuit, and Cunningham will be able to take delivery of one of the first single-seater Maseratis, built to take either the 3-liter four, for Intercontinental Formula racing, or the 1½-liter four for the U. S. Grand Prize at the end of the year. The re-entry of Maserati to the single-seater field, after an effective absence of three years, will be watched with great interest.

—Karl Ludvigsen



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LETTERS

WHAT IS A SPORTS CAR?

My friend and I have had many arguments as to the true nature of a sports car. We have also come to blows as to whether or not the Corvette is considered, in the true sense of the word, a sports car.

I would appreciate it very much if you would give me some information about:

1. The standards of classification of a sports car.
2. Who sets these standards?
3. Is the Corvette considered a true sports car or not?

Howard Finkelson
New Brunswick, New Jersey

A sports car is often nothing more than a state of mind possessed by a vehicle's driver, but we can be a little more concrete as there is a general area of agreement as to its definition. It is generally a two-seat coupe or roadster in which optimum performance is the goal of the makers. It is often a de-tuned racing car rather than a hopped-up production car although many of today's sports cars fall into the latter classification. It is designed to help the driver travel as fast as possible with the greatest amount of safety possible. It is a car designed to be raced and generally driven at high average speeds.

With increased standards of performance at last becoming normal for manufacturers of conventional automobiles, the borderline between sports car and passenger car is fast obscuring. This relatively new breed, usually lumped under the heading of G.T. or Grand Touring cars, appears to have caught the fancy of both buyers and builders. Actually, it's almost a kind of regression to the early days when all cars were sports cars.

In this country, standards for sports cars are generally accepted to be those set by the Sports Car Club of America. However, the Federation International de l'Automobile *(F.I.A.) and the United States Auto Club have classifications too. Needless to say, any attempt at rating cars is difficult (some say it's impossible to put cars in set groups).*

With regard to your third question, the Corvette is absolutely a "true sports car." If you have even the slightest doubt, drive one. Our most recent test of the Corvette was in the December, 1960 issue. We conducted a Road Research Report on the '61 Fuel Injection model.

Readers' comments are invited.

EASY SHIFTING

The excellent Sprite report almost makes me want to buy one, much as I am in complete disagreement with the "economy" of copying the styling designs of amphibious objects, living or dead. Regarding the gearboxes, I discovered an interesting item while changing the ratios for use in a Sadler F. Jr. The shifting rods had a liberal coating of rust with the majority of it in the area where the rods go through the extension.

Not only does this bring up the sobering thought of "If this is rusty, what do the rest of the unseen parts look like?", but it may also explain the long break-in period while the rust wears off. After much polishing with fine emery cloth and finishing with crocus cloth, the rods were shiny and smooth. A bit of polishing within the rod holes in the aluminum extension, and the whole works acted like the proverbial hot knife through butter.

It would seem that the simple polishing and rust removing would be within the scope of most motorists, possibly with the "hard" work done by his friends at the local shop. It would at the very least be a saving over the idea of switching complete gearboxes when trading Sprites!

So disc brakes are good, but are they of any use to the average guy when compared with good drum brakes? After having owned VWs, MGs, TRs, Volvos and now an Alfa, it is quite disconcerting to get into a car with *un-assisted* disc brakes, and have the horrible feeling of "Oh, oh, — no brakes" every time you want to slow down. Pedal pressure exceeds that of any truck I have ever driven and equals only a few farm tractors. The first application in wet weather is a gamble second only to Russian roulette, — will you stop, not stop, dive left, dive right, or do a complete spin? Get the brakes good and wet in freezing weather, and they make the best emergency brakes there are; *nothing* will move the car short of lifting it up bodily.

Disc brake pads in most instances have to be replaced with the frequency of boxes of cereal in a home where box tops are in great demand. Complaints of poor gas mileage in TR-3s very often are cured by the more or less simple matter of removal of the pads and cleaning them.

In this part of the country, salt is a great friend of highway departments, and a great enemy of disc brakes. On my last Volvo, the brakes were never relined during the 69,000 miles while I owned the car, although they needed it by the time I traded it in. A TR-2 with drum brakes ran as many miles and was nowhere near the time when a reline job was needed, although the car had been raced to some extent.

To sum it up, the car costs more because of disc brakes, they need relining much more frequently, and they cause much more trouble. So why bother with them? And to road testers who need a real thrill, disconnect the vacuum line to the booster on a Jag with disc brakes, bleed the vacuum down by using the brakes, then start out and get up to a speed of 80 or so. Then try to stop. You can obtain the same effect by having the lines break unknowingly while driving normally. With a near-useless emergency brake, the safety factor approaches nil.

Out of curiosity, do you know what the actual rear wheel horsepower of a standard Sprite is on a dyno? We finally reached 45 b.h.p. at the rear wheels on the Sadler Jr., and various opinions seem to place the standard between 25 and 32. We would like to know just how efficient our "do-it-yourself" tuning is. The 45 b.h.p. figure was

(*Continued on page 8*)

fuel injection!

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Chevrolet Division of General Motors, Detroit 2, Michigan

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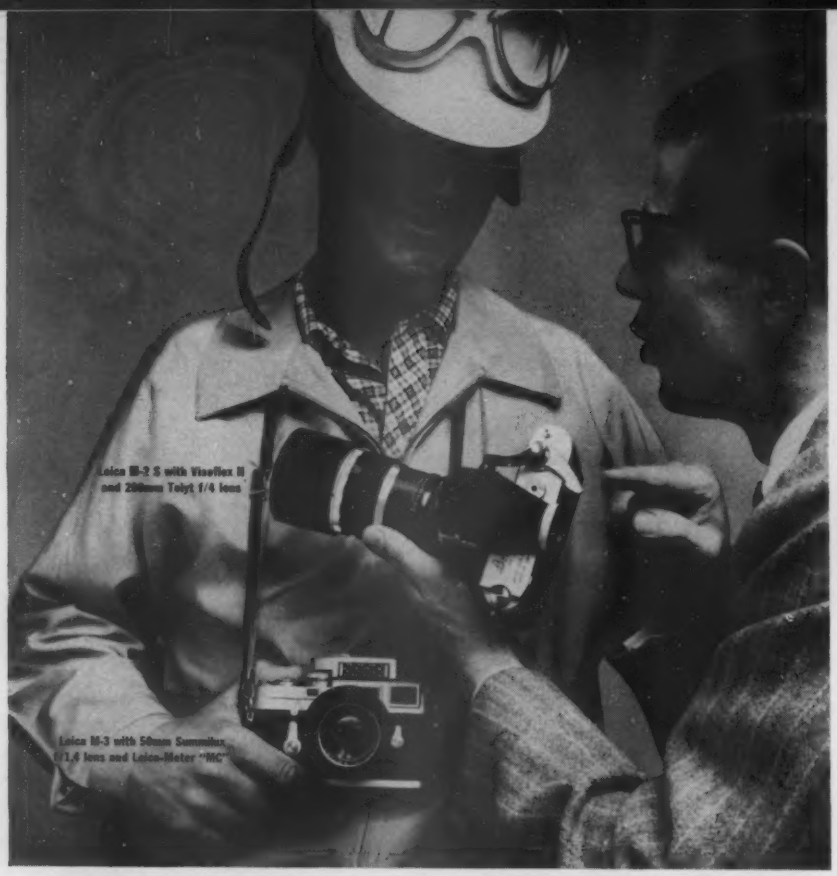

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(Continued from page 6)

reached at 5000 rpm, incidentally, although we have run it as high as 7800 rpm when necessary, which is most of the time with a 4.55 rear axle ratio and 5.90 x 13 "X" tires. With a 4.11 gear set and a "quick-change" ratio obtained by substituting a set of 6.40 x 13 tires, we hope to stay under 7000 this year.

R. G. Nugent
Dansville, New York

SPRITE DRIVER CITES RRR

Time was when I considered the Road Research Reports, and other articles of the same nature, as something to be taken with the proverbial 'grain of salt'. I have just read the report on the Austin-Healey Sprite in the April CAR AND DRIVER issue and I wish to apologize for my gross near-sightedness and underestimation of your capabilities. This was one of the finest pieces of research and reporting one could hope to find on such an intangible thing as an automobile's driveability, etc.

I certainly do not consider myself an authority on the Sprite, but I have owned one for nearly a year, have driven the car more than 15,000 miles, including city, country and just plain 'mean back-road' driving, and I feel that I have, at least, a fair knowledge of the automobile. Your researchers managed to sum up, in a few pages, what it took me several thousand miles to learn. The seemingly insignificant idiosyncracies of the car were brought to light in such a comprehensive manner that I feel the total stranger could read your article, step into a Sprite, and feel at home almost at once.

One thing occurs to me as I write, and I mention it because it seems to be almost universal with the Sprites with which I have come in contact. Since my car was new, I have had to pump the brakes once in order to avoid having the pedal travel nearly to the floor. I have talked to other Sprite owners, mechanics and fans, and have observed many Sprite drivers, and most seem to agree with me, that this brake-pumping seems to be necessary on most of the cars. Needless to say, this is very annoying, and could, under proper conditions, be very dangerous. Many people seem to be aware of this, but nobody seems to know what to do about it. Not being extremely mechanically minded, I am at a loss to know either the cause or the remedy for this. May I have a hint as to what to do before I wrap myself around the trailing edge of somebody's automobile?

Again, thanks so much for your fine work. I assure you that you have made a loyal fan; one who will henceforth pay humble homage to your honest efforts.

Norman S. Hartman
Clovis, California

Sprite brakes are definitely not supposed to have a spongy feel, nor should they require pumping for good stopping action. The indications are that you have air in the system. First try bleeding the brakes; you may have let the fluid level get too low. If the phenomenon recurs, overhaul the master cylinder and/or wheel cylinders. One or more of the seals in the cylinders could be defective.

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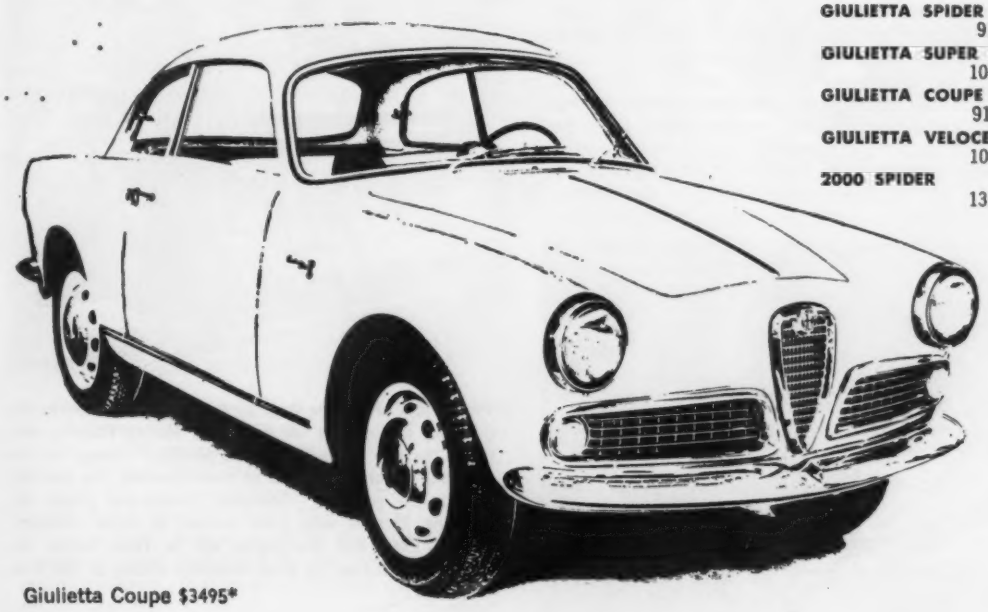

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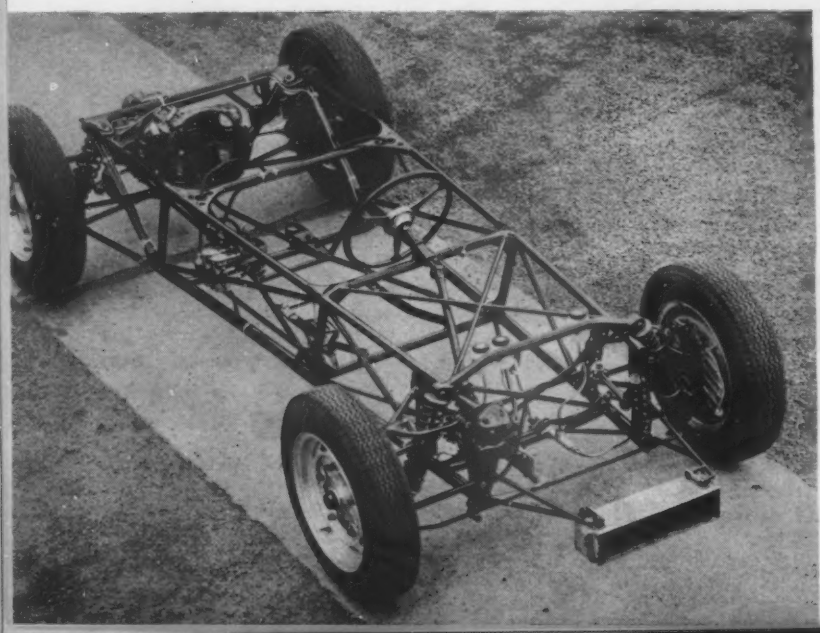
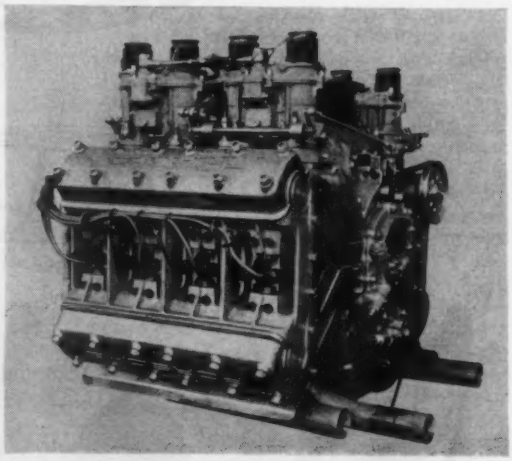
PORSCHE'S EIGHT!

As we've said, this new Grand Prix Formula will produce some bombshells! Still in the development stage, the new flat-eight from Stuttgart looks designed for production but for now Porsche will be pleased if it competes sometime this season.

Injection can be fitted but the unit is shown with Weber downdraft carburetors used for early testing. Its bore and stroke are 66 x 54.6 mm for 1498 cc, producing a stroke/bore ratio of 0.83. This is less oversquare than the 0.78 ratio of the old four, showing the compromise in bore size needed to reduce overall engine length. Compression ratio is 10 to one, slightly higher than the four, and dual ignition is supplied by twin Bosch distributors high at the back of the crankcase. The whole engine shows signs of design for die casting, especially the cylinder heads which are cast separately for each cylinder, then topped by the one-piece camshaft housing you see in the photos. It's possible this whole housing may be changed to fit the alternate desmodromic valve gear; springs are said to be used here. Each camshaft is driven directly by a shaft and bevel gears from the crankshaft, apparently from the crank center, where the drive for the flat-placed cooling blower is also located.





Though this shows the front of the engine as fitted to the G.P. car, it would be the back in a touring Porsche, and that's the way the exhausts are pointing! Pumps for the dry-sump system appear to be front-mounted, like the belt drive to the generator. Crankshaft breaks new ground for a racing Porsche with plain instead of roller bearings. It's not likely that the engine will be raced before the Belgian G.P. on June 18, when its output should be 180 bhp.

After practically inventing the torsion bar and trailing link front suspension, Porsche has abandoned it in favor of coils and wishbones in the new chassis, which is set to race at Monaco with an improved edition of the older four-cylinder engine. At 90½ inches the wheelbase is up from the old 87 inches, and the frame is lower and wider.

TECHNOTES

Each month we receive many more letters than we can possibly answer either in this column or individually. We are delighted to get them because it keeps us in direct touch with you readers and what you're interested in, but we beg your indulgence if you don't get the information you're seeking. A few letters which seem to typify the questions we're getting are selected each month for publication herein.—SFW

POLAR MOMENT OF INERTIA

Can you please give me the meaning of the term "polar moment of inertia". I have found it in the public library here, but that left me more confused. I have already written to another leading sports car magazine but they have said that it was too technical to answer. I realize that it is hard to explain, but any help will be greatly appreciated.

Peter Lee Borchelt
Cincinnati, Ohio

Well, it is pretty technical, but since this is a popular question, we'll give it a go. It's involved and we'll have to get at it by taking several small steps rather than one big one. First, there is the term "inertia". Inertia is the tendency of a body to maintain whatever velocity it has. A body at rest will remain at rest until disturbed by an outside force. (Sounds like some people we know.) Inertia in a linear sense (straight-line motion) is measured as mass, the weight in pounds divided by "g". There is also rotational inertia or flywheel effect. It is measured by both mass and size or rather dimensions. What counts is the distribution of the mass.

But to go back a moment, you are all, I hope, familiar with the fact that a flywheel is "hard" to start turning and, once turning, it tends to keep on with only friction gradually slowing it.

The "moment of inertia" has nothing to do with moments of truth or any time concept. The word moment is used here in the same sense as in the phrase "twisting moment". The latter is "force at a distance" and moment of inertia is "inertia at a distance". Computing it for an object involves calculus, but talking about it doesn't so let's keep on. The moment of inertia of a body is usually measured about its center of gravity (and about the axis which gives the least value, the same axis about which the object "prefers" to rotate). The moment of inertia is the summation of all the little masses involved multiplied by the square of the distance from their individual c.g. to the same axis.

If you're still with us, the rest is easy. Polar moment of inertia is measured about another axis perpendicular to the one mentioned, an axis which gives the highest possible moment of inertia.

If you hold a weight-lifter's barbell at the center and try to spin it like a drum-

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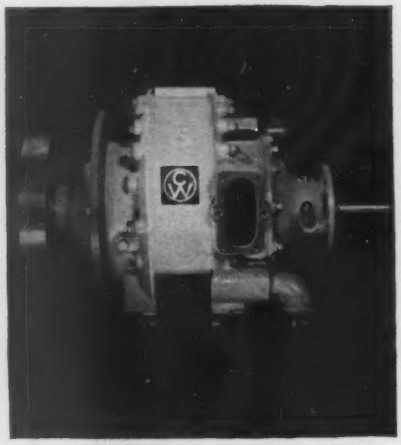

2. What interesting new type of experimental engine is this?

3. Pit stop! What's good time for a wheel change? ( ) 20 sec. ( ) 40 sec. ( ) 80 sec.

4. What does this symbol stand for?

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majorette's baton, you're fighting its polar moment of inertia. (If you just roll it across the floor, that's overcoming its principal moment of inertia.)

For automobiles, a car rolls (over and over) along its principal axis, the longitudinal one down the centerline of the car. Whether its true polar axis is vertical or horizontal is academic, because common usage assumes the vertical axis is the one referred to.

In brief, the polar moment of inertia is a measure of the amount of resistance the car will offer to spinning (and also, and not to be neglected at all, to stopping a spin). Like a bar-bell, a car with the engine way in front and a big gas tank way at the rear will have a high polar moment while a mid-engined car will have a low one.

The scrub of the tires also resists spinning but this is not a part of the moment of inertia. As the car spins, tire scrub is a moment or couple that works against the polar moment of inertia to stop the spin.

Now then, the reason automobilists are interested in polar moment of inertia (abbreviated I_P in engineering circles) is that it is a most significant item in determining the directional stability and controllability of a car. Short little cars such as F3s or karts are very easy to spin, but equally easy to straighten out of a spin. Big, long front-engined cars such as Ferrari has long made have large values of I_P, are very stable even on the longest, fastest bends, but are not at all nimble when it comes to gymkhana-like hairpins.

End of lecture. Did you learn anything? If not, consult your librarian if she's pretty or your nearest physics instructor if she isn't.

CORVAIR TIPS

I read with great interest your article on the modified Monza. One simple change was neglected. Remove the highly restrictive A.C. air filters and connect connecting duct, substituting Fram CA169PL-2 paper filters. These are a special size made by Fram as replacements. When installing them, turn the openings in the filter cases at angles toward the fan case.

The result with my car (3.27 final drive) is a gain of 10 mph in third gear, peppier acceleration and much improved gas mileage (as much as 24 mpg on highways). A friend's had equivalent improvements with his 3.89-equipped Monza.

Still more performance can be obtained by blocking open the two thermostatically controlled motor air vents with tapered wooden blocks inserted from below and wedged under the metal flaps. However, this affects the efficiency of the heater somewhat and also requires a slightly longer warm-up period.

Running with a well-glazed and loosened fan belt (i.e., loosen the idler pulley until the generator can be easily turned by hand), I have obtained 0 to 60 times of 13½ seconds.

Maurice M. Scott
East Lansing, Michigan

Thank you for all these tips. As a professional doubting Thomas, I'll have to ask rhetorically if that's a zero to sixty indicated or if you've calibrated your speedometer. Even if you haven't, that's a mighty big improvement all right, especially considering your 3.29 to one axle ratio.

Racing Ace Johnny Mantz completes oil check on a '61 Galaxie driven at 120 mph at Ford's Kingman, Arizona, Test Center.

THEY HARD-PEDALED A '61 FORD OVER 4,000 MILES...

and the oil stood the test beautifully!

Reports Johnny Mantz: "This machine really got a workout ... across the desert from Needles to Nogales and down the pike from Boise to Broken Knee. It was smashed over hot desert sand...into water traps at high speed...and crawled through city streets. Afterwards, they brought it back here to Kingman, where I drove it at 2 miles a minute. Then they dumped the oil and checked it. No sludge in this crankcase! Ford's new full-flow filtering rig really works. 4,000 miles between oil changes. Easy with this one!"

Johnny Mantz

THE '61 FORD!

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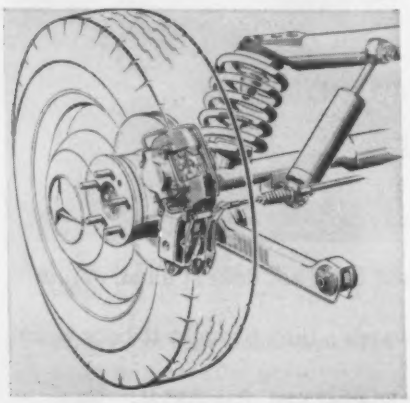
FORD DIVISION, Ford Motor Company,

EUROPEAN NEWSLETTER

The announcement of the new Mercedes 220SE coupe brought the international automotive press to Stuttgart for brief trials and a first visit to the new Daimler-Benz museum. The former overcrowded and poorly lit museum has been replaced by a modern, beautifully executed display area adjoining the Mercedes "skyscraper" in Untertürkheim. The cars are laid out according to periods, and on the top floor the Mercedes racing cars of yesteryear are separated into three different epochs. The first is known as the "classical" epoch which terminates in 1914, followed by the supercharged epoch including the "S" to the "SSKL" sports cars, the 750 kg Formula car, and the 3-liter blower car. The third epoch relates to the post-war period and the famous series of Mercedes racing machines beginning with the 300SL and ending with the 2.5 liter W196 and 300SLR. High point on the top floor is a completely renovated W196 F.1 chassis, done in black with all metal parts heavily chromed. There's even an airplane in this Daimler-Benz museum; it's the first aircraft ever to fly scheduled passenger runs in Germany. Powered by a D-B engine, the fabric-covered bi-plane dates from 1921.



Dunlop disc brakes are featured on the latest 300SL Mercedes. The rear unit pictured uses the self-adjusting handbrake, a Dunlop innovation.

Following test runs in the coupe, we were shown several interesting sections of the research department at Mercedes. The tire testing area was impressive, dominated by a machine capable of running tires at speeds up to 186 mph under varying loads. Examples of all makes of tires supplied on Mercedes cars are tested here prior to their acceptance, and experimentation is continually going on. While there, the tests to determine stopping distances on ice with different types of tires — with and without chains or spikes — were being recorded. Typical of the data now at their fingertips is the knowledge that a Continental racing tire can be run steadily for 25 minutes at 149 mph before giving up the ghost; a German Dunlop B7 will stand exactly 8 minutes at 124 mph (this is the standard tire for the 220SE sedan and coupe, cars with a maximum speed of 107 mph). In the basement of the experimental department was a shock absorber test rig on which one of the shocks taken from Kling's African Rally car was being slowly destroyed as its operating temperature went up. At 392° F there was a cloud of smoke as the seal let go and the hydraulic fluid shot out. D-B designs and builds much of its own test equipment while the tire tester was a Schenk product, the same German firm that makes engine dynos.

BORGWARD TO STAY

The serious financial problem at Borgward has been in the news recently. A sharp decline in overseas sales and heavy development costs for the new 2-liter sedan helped put Borgward deeply in the red. Control of the plant has been relinquished by Carl F. W. Borgward himself; the city of Bremen has kicked in 50 million Deutsch marks and from now on belts will have to be tightened until the situation improves. One thought is that rather than have spent an enormous sum developing the "Grosse Borgward", Carl Borgward should have concentrated on making the 1.5 liter Isabella *the* best car in its class to compete even more strongly with Opel and Ford Taunus, Germany's two largest selling one and a half liter cars. As it stands now, his problems will only be increased when the new 1.5 liter VW is put on the market.

VW-1500 TO CANADA?

News of the VW-1500 is scarce, and though it is not scheduled for sale in the United States, the word is that it will be available in Canada early in '62. It will *not* replace the current VW-rather it will supplement the line — as indicated by Director Nordhoff almost a year ago. There is space aplenty at Wolfsburg and at this moment production of the larger vehicle is getting rolling.

PORSCHE HARDTOP

An addition to the Porsche line is the new Karmann "hardtop". Not really a hardtop in the true sense of the word, this car has lines identical to the Reutter convertible fitted with detachable hardtop, the difference being that on the Karmann model the top doesn't detach. Quarter rear-opening ventilation windows are standard.

GREAT EXPECTATIONS?

Some European observers feel that Volkswagen's dive into the "big displacement" race has created more of a ripple than a splash. While the carefully worded factory press releases about the car left many questions unanswered and technical details are virtually unknown, there was some feeling of disappointment surrounding the announcement of the VW-1500.

Generally it is conceded the car has a clean, attractive appearance, but some feel that it has been born five years too late, looking much like the 1955 Taunus 1200. Perhaps some of this disappointment is due to the public's expectations being placed too high. It was felt that since the factory had waited so long in introducing the new model, the new VW was likely to be away ahead of its time both technically and esthetically. Citroën fulfilled similar hopes in 1955 when it brought out the revolutionary DS-19 after having built the famous "Onzes" and "Quinzes" with practically no changes since 1934.

PRIVATE PARTY

John Ogier's Essex Racing Team will make its biggest effort this year at Le Mans, staging a massive attack (for a private equipe) of three cars. It will field two new Aston Martin Zagato G.T. coupes and a DBR1 sports car.

Five drivers have been selected for the 24-hour race. They are Roy Salvadori, Jim Clark, Innes Ireland, Tony Maggs and an upcoming French *pilote* named Tavano. The sixth remains to be announced.

While Le Mans will be the keystone of Essex's '61 competition, the team will also campaign in most of the classic European sports and G.T. events. In addition to the cars above, the team owns a drastically lightened but otherwise normal DB4GT. Essex's major post-Le Mans attempt is expected to be the Tourist Trophy at Goodwood in August with hopes of surpassing its 1960 record of second and third places and the fastest lap.

BMW CITES GAINS

While Borgward in the north tries to sort out its problems, the other sick German car factory, BMW in Münich, is slowly getting back onto its financial feet, under the leadership of a new technical director, Robert Perthuss, formerly with Karmann in Osnabrück. The Bavarian factory is back-ordered on V-8 sedans, of which four different types are currently being made. The Super Deluxe V8 is the first German

(*Continued on page 16*)

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(Continued from page 14)

car to offer disc brakes (now joined by Mercedes—both the 220SE coupe and the BMW V8 Super use discs on the front). But besides 40-50 Isettas per day, and 15,000 motorcycles annually, the BMW 700 is enjoying increased sales throughout Europe, especially in export markets. It too is available in four different versions and going into production now is the BMW Sport, a 46 bhp (SAE) model of the 700 cc two-cylinder air-cooled engine. This is the car that Hans Stuck drove last year to victory in the European Hillclimb Championship. BMW intends to participate more extensively in competition in 1961 and for special private owners an even more powerful version of the engine will be available. CAR AND DRIVER has requested a BMW 700 Sport test car so we'll soon be able to report first hand on the performance of this Bavarian Bomb. BMW is also manufacturing stationary and marine engines and at the BMW-Allach plant a gas turbine stationary power plant as well as Lycoming aircraft engines are being made (the latter under license). BMW will introduce a new 1.3 liter car in midsummer 1961, with lines similar to the present "700" styling.

FERRARI TESTING

Everyone at Maranello is delighted with the performance of the rear-engined 2.4 liter V6 sports car which Richie Ginther, Ferrari test driver, has been putting through its paces at the Modena autodrome. After almost 100 laps, Ginther got down to a comfortable 59 seconds and felt that there was even more in hand with further refinement of the chassis. This sports car is practically identical to the Formula 1 machine and is a far cry from the heavier and bigger 12 cylinder Testa Rossa Ferrari sports cars. Except for the 2+2 G.T. cars, there soon won't be a front engined car to be seen at Maranello. Testing of the new sports car was held up, first by a crash on its initial outing when a brake disc went to pieces with von Trips at the wheel, then by a long delay in getting replacement parts from Dunlop in England.

FIAT 1300 TO BOW

Announcement of the 1300 Fiat has been scheduled for the Turin Automobile Show in November next. Don't be surprised if Fiat soon offers a 1.8 liter diesel engine; such a car has been under test for some time.

CUNNINGHAM LE MANS BID

It seems that Jaguar will not be offering a car to Briggs Cunningham for Le Mans this year and Briggs has recently been in Modena visiting Maserati and testing the Tipo 63 rear-engined birdcage. Stirling Moss and Walt Hansgen have been in Italy to drive the car. If the Tipo 63 shows promise at Sebring Cunningham will enter two of them at Le Mans.

Using a layout similar to one used by Ferrari in 1960, Stanguellini Formula Juniors are now being equipped with an independent rear suspension. In addition to being available on new cars, the modification can be carried out on previous types.

Only the rear end of the basic Junior frame is changed, with the addition of a

(Continued on page 18)

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"Shorty" with visor $36.50 ppd., less visor $35.00 ppd.
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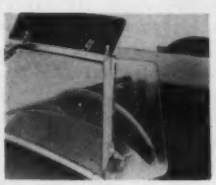

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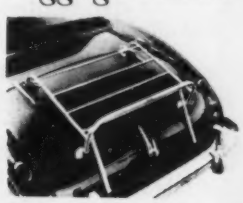

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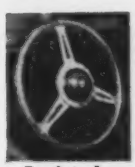

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State make, year, model of car.

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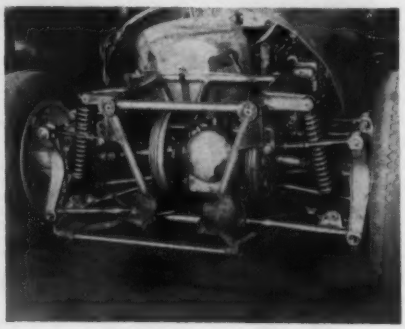
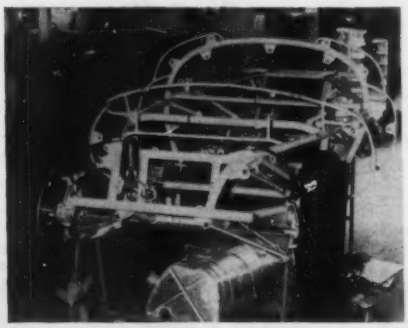
(Continued from page 16)

new framework to support the new suspension. Magnesium alloy outer hub carriers are a Stanguellini design, guided by chrome steel tubular wishbones. The wishbones are adjustable for length and have alternate anchor positions for experimenting with the roll center height.



The frame-mounted differential is new, having a cast aluminum housing and inboard drum brakes. Each drive shaft has two universal joints and sliding splines, with the right shaft being shorter than the left since the differential, like the drive shaft, is to the right of the center of the car. For bringing former juniors up to the specifications of the independent rear suspension model, Stanguellini's price is about $650.



New Cooper sports racers will use coil springs front and rear and have a lower engine mounting.

BITS AND PIECES

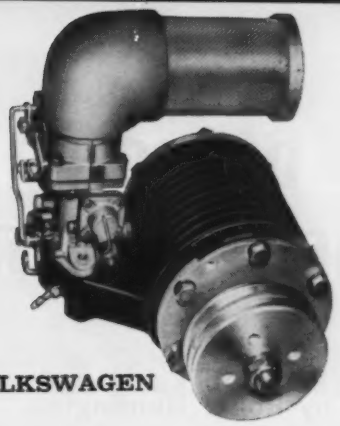
A newcomer to the G.T. world, the Facellia, driven by Maurice Gatsonides, earned first in its class in the Monte Carlo Rally. There was a Road Research Report on the Facellia in the February '61 SCI.

Trials of the successor to Donald Campbell's ill-starred Bluebird are expected to begin in August, preparing for another crack at the Land Speed Record . . .

Porsche claimed national championship titles in 19 world-wide categories during 1960. . . . VWs swept the field in 400-mile rally between Blantyre, Nyasaland and Quelimane, Portugese East Africa nailing down first overall, 2nd, 5th, and 8th. 1, 2 and 3 in class and team prize . . . Yeoman Credit Racing Team's manager, Reg Parnell disclosed John Surtees will hold down the No. 1 slot for the coming season. Team mates include Roy Salvadori. The Yeoman Credit team will field three Lotuses.

MG-A

TRIUMPH TR-3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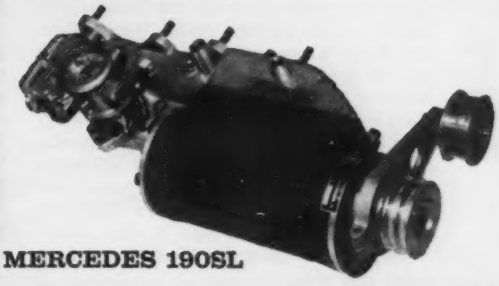
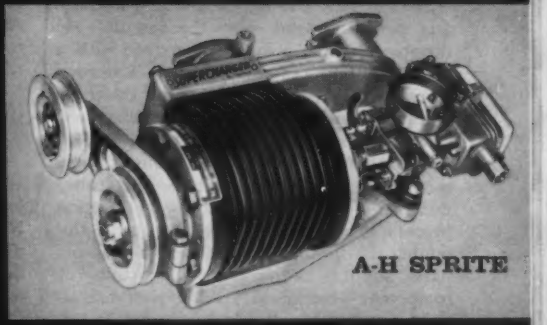

MERCEDES 190SL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DETROIT NEWSLETTER

by Roger Huntington

Looking like the Canadian Winter Rally winner, the Corvair SS idea car has a modified engine, wire wheels.

The 1961 Pontiac is America's fastest stock car, judging from the competition results of the Daytona Speed Weeks. Fireball Roberts cut a practice lap at 157 mph on the 2½-mile paved speedway, in a '61 two-door hardtop set up by master mechanic Smokey Yunick. He averaged 155.7 mph for a 10-lap heat race — and had a lap on the whole field in the 500-mile race when his starter motor came adrift and punctured the oil pan only 13 laps from the end. He was averaging 150 mph at that point! Nobody could touch the Pontiacs on sheer speed this year.

Closest was Curtis Turner in a '61 Ford with the new 375-bhp engine, whose 10-lap heat averaged was 153.5 mph. He dropped out early in the long race with a water leak. Teammate Fred Lorenzen brough his Ford in fourth, behind the three winning Pontiacs. The much-heralded new power options from Chevrolet and Dodge-Plymouth failed to impress. None of these cars lapped above 150 mph. Neither camp was really ready in time this year. Engine prototypes were still on the dyno on the December 10 spec-filing deadline, and ample parts supplies weren't in the hands of competent professional racing men for almost another month. It just takes longer than that to develop a 155-mph stock car, regardless of how many cubic inches or how much compression the factory gives you. Also money helped clobber the Plymouths and Dodges. The beautiful streamlined exhaust headers from the Chrysler 300 series wouldn't clear the upper suspension arms on the shorter D-P chassis; the racing budget wouldn't permit a change in the casting patterns — so the D-P camp dropped a clean 45 bhp right there! Buck Baker switched to a Chrysler Newport and went 2 or 3 mph faster.

As far as that goes the Pontiac boys weren't entirely free from deadline problems. The Pontiac factory engineers never seem to rest on performance development these days, and the timetable can get a little fouled sometimes. This year they sent Smokey Yunick a new 4-barrel carburetor with larger venturis and a new lightweight aluminum radiator — only a couple of weeks before the big races. NASCAR officials wouldn't let him use them. The rules say all equipment (except a few special exceptions) must be listed in the AMA specification sheets and filed with NASCAR by December 10 to be eligible for Daytona. The new carb and radiator weren't included in the official specs, so no go. Smokey seemed to get along pretty well without 'em, though!

The compact car race over the 3.1-mile road circuit didn't draw nearly as much interest as expected. A slim 18-car field played before a small house. The manufacturers didn't put much into it. Lee Petty won the 150-mile feature at 83.6 mph in one of the '60 Valiants he raced last year. The special Daytona kit (not the one you buy from the dealer!) gave him an honest 190 bhp and a top straight-away speed of 132 mph! Fireball Roberts gave the Valiants some competition in a 155-bhp Tempest — even leading the race for the first 25 laps — but Petty moved out after his pit stop. The Valiants were apparently 2 or 3 mph faster on lap speed than the Tempests. Incidentally, transmissions gave a lot of trouble on downshifting on many of the cars, indicating the gearboxes on these compacts are no more than adequate for their job. It was very enlightening.

WINTER CHAMPION DRAGS

Just as we were getting used to the idea of Pontiacs at the head of the 1961 performance parade, results came in from the National Hot Rod Association winter championship drags at Pomona, California. The new Pontiacs weren't a factor in the top stock classes out there. Chevrolet dominated the top three classes, and their toughest competition came from Fords. Owner-mechanic Don Nicholson worked some of his tuning magic on one of the new 409-cubic inch 360-bhp Chevys, and time-trialed at an unbelieveable 108 mph and 13.25 e.t. in the "Super-Stock" class. I figure it takes pretty close to 420 honest horses to go that quick with a 3700-pound car! I doubt if any of the NASCAR mechanics were getting more than that at Daytona. (Though, of course, getting 400 bhp to stand up for 500 miles might be more of a trick than getting 420 bhp for 13 seconds on the drag strip.)

Anyway I can't see that Pontiac drivers will have things all their own way in the various forms of stock car competition this summer. With more development the Chevys or Fords or Chrysler models have the potential to stay with them. The big question is whether the factorys' engineering departments will put as much effort into performance development as Pontiac does.

JUST ONE LEAF

An article in AUTOMOTIVE NEWS predicts that Chevrolet will use single-leaf rear springs on a new senior compact model to be brought out next fall. This development has been inevitable for years. A single-leaf spring weighs less, is potentially cheaper to produce, and you get rid of the inter-leaf friction that harshens the ride — (and which, incidentally, has been bugging auto engineers no end for 30 years).

The big problem was a practical, economical production method. A single-leaf spring has to be *thicker* in the center than at the ends, just as multiple leaves are stacked in a tapered pattern. Rolling the tough steel strips from which springs are made with a varying thickness was a challenge for the tool men. Chevrolet's "breakthrough" idea is to roll the tapered spring from a straight rectangular strip of steel — and then let the strip *spread out in a wider width* where it is rolled down to a smaller thickness. In other words the finished spring will vary in both thickness *and width!* What could be simpler? I recall seeing a display at a recent SAE meeting by Rockwell-Standard of a single-leaf spring. But theirs was rolled in a special die that held the width constant. The Chevy method should be cheaper.

This could be a very important development in the engineering evolution of the American car. Coil springs do a nice job with the ride, but they require elaborate suspension control linkages that add to the cost. Leaf springs act as their own linkages — and a single-leaf spring without inter-leaf friction should give as good a ride as coils. We'll see. (GM used simple single-leaf rear springs on the Schilling-designed Firebird I chassis back in 1954.—Ed.)

SMALLER BIG CARS

A word about these new "senior compacts": actually they will be larger than what we know as senior compacts now (Olds F-85, Buick Special, Comet, etc.). They will be somewhere between the size of these cars and the current full-size Chevrolets, Fords and Plymouths. Wheelbase will be around 115 inches and overall length about 200. Manufacturers feel this might be the size of a typical 1965 family car. (Current full-size cars have about 120-inch wheelbase and 210 overall length; senior compacts run near 190 overall and 112-inch wheelbase.) The word is that Ford, Plymouth and Chevrolet will offer this size car in 1962. Entirely new body shells are likely from Chev and Ford, at least — and engines will probably be adapted from current production designs.

The industry is groping — there's no question about that. Certainly at no time in the last 40 years has there been more uncertainty about what will sell and what won't. The day when a GM division general manager could walk into a styling studio and point out the right model to produce is gone forever! —*RH*

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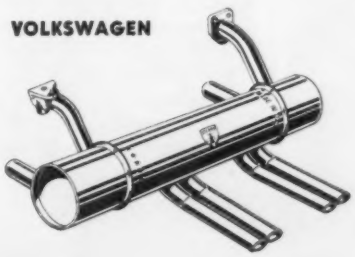

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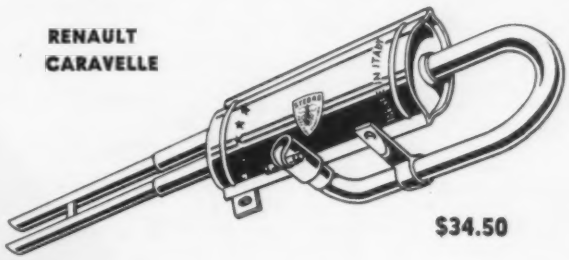

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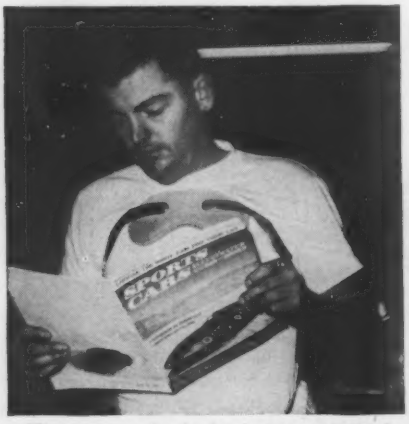
PIPELINE

Go, Yankee! **Mickey Thompson,** world speed king, plans to launch his own one-man "invasion" of the Soviet Union this year. "I hear they love American jazz; they're bound to like American hot-rodding," he says.



Thompson, who is the fastest motorist in history, having set a one-way average of 406.60 mph and claiming all the world's records for acceleration and top speed with the exception of the flying-start kilometer and mile, plans to **take a pair of record machines to Russia** providing the Red government okays the move.

On November 6, Thompson broke his back in a speedboat accident on Lake Mead, Nevada. Within three days of having to lift his foot from the throttle with his hands, he was able to move slightly and began the hard job of attaining total recovery. Thompson's record of fantastic courage took on a new light.

Jaguars are now being distributed in Florida, Alabama, Georgia, North Carolina, South Carolina and Tennessee by the capable **Roosevelt Automobile Co.,** of Washington, D. C., whose president, Franklin D. Roosevelt Jr., backed the successful Team Roosevelt, winner of two class champions last year.

The durable Old Yaller I has been rejuvenated and is now known as the Larkin-Hauser **Lioncage Special.** Eric Hauser wheeled the mount to a first spot in the amateur race preceding the Pacific Grand Prix in October.

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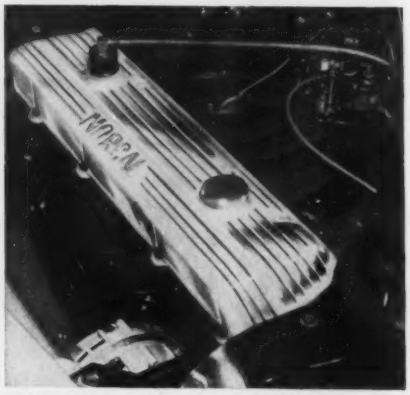

valve cover. Here's one for Lancers and Valiants by Nor Cal. Send $1 to Nor Cal, Dept. C/D, P. O. Box 1928, Stockton, California for details including a catalog of compacts' accessories.

More powerful engines are available in new Porsche Carreras, both in the lightened Reutter body and the light alloy Abarths. Two distinctly different exhaust systems give power ratings of 145 bhp @ 6700 rpm (with the sport exhaust I) and 150 bhp @ 7400 rpm (with the sport exhaust II). System I gives a wide power range starting at moderate rpm while system II

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The '60 European rally championship was claimed by the team of Shock and Moll driving a Mercedes-Benz 220 SE, repeating their 1956 performance on another Mercedes.

Speaking of Mercedes, The M-B Club of America will hold a Mercedes-Benz Range Ride, July 1 through 4 under the sponsor-

ship of the Humboldt County Chamber of Commerce. Starting from **Winnemucca, Nevada** with a party on Saturday night, the events will begin Sunday with a gymkhana and an autocross, to be followed by a barbecue. On Monday there will be drag races and a concours. Costs for the weekend are $45 for one, $65 for two, including all expenses. Reservations may be made by contacting the Chamber of Commerce, Nixon Building, Winnemucca, Nevada.

"Imported" from the United States, this **1909 Lancia Speedster** was bought for the Museum of Motor Car History in Turin (see C/D, April, 1961) from Frankie Watts of Waco International Salon in Miami. The four-cylinder Lancia was once part of James Melton's collection; in its prime it won honors at Daytona and in the Vanderbilt Cup races.

A useful accessory for the Sprite driver is the locking trunk partition available from CEP Products, Dept. C/D, Union Lane, Cambridge, England. Located just aft of the seats, it keeps trunk space at a maximum while security for personal property is assured. The unit mounts easily and looks attractive, finishing off the rear of the cockpit. It's priced at 4 pounds 10 shillings (about $12). The sturdy partition is covered in leather cloth so include the color of your Sprite's upholstery with your order.

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TR Battery Well Liner ends the problem of disintegrated body metal and unsightly or holey carpets caused by displaced battery fluid. Made of lifetime plastic is corrosion-proof, requires no tools to install. Send only . . **$5.95 ppd.**

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Gloves make motoring more comfortable and protect the hands against blisters. Two styles: **Grand Prix** (shown) with cape palms and vented backs, **$7.95 ppd. Leston,** cape palms, mesh backs, **$6.50 ppd.** Grand Prix are natural or black, Leston, natural only. Sizes 6½ to 10.

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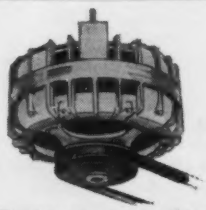

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CAR and DRIVER
JUNE • 1961

FERRARI TAKES THE TWELVE-HOUR!

by Karl Ludvigsen

Maserati was fast and defending champion Porsche was well-armed but the array of magnificent new machinery from Maranello brought victory to one of the greatest endurance teams in racing history.

► Last year we predicted a bigger and better Sebring in 1961 — it had to be; it couldn't have been much worse! It had to be, indeed, but on its own merits the '61 Sebring will go down as the finest — and the fastest — in the eleven-year history of the event. Radical new rear-engined cars were the talk of the town, but the results this year — like those in the past — show that the safest bets at Sebring are always on the most reliable teams and not on the hotshots, however fast they may be. The winners, as in 1959: Phil Hill and Olivier Gendebien, in a front-engined V12 Ferrari.

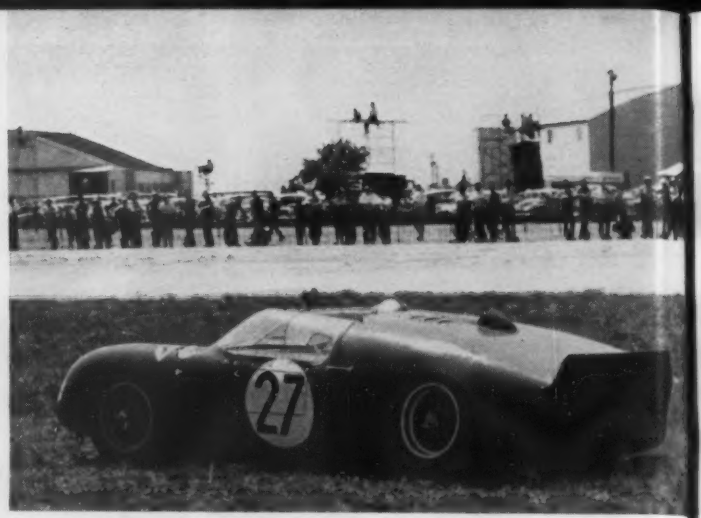
The Ferrari entry was certainly outstanding. Heading the list were the three factory cars, two of them being the Type TRI/61-Sport, fundamentally the same as last year's all-independent Testa Rossa V12 sports-racing car. Use of a dry sump and all-indirect engine-mounted gearbox had already lowered the powerplant substantially, but further lowering was found possible in '61, and thus a lower center of gravity was achieved. The most obviously new feature was the dramatically streamlined new bodywork, based on wind tunnel studies as C/D reported last month. The very high tail shape is caused entirely by the required windshield height and width, and the lip across the top of the tail was found necessary to combat aerodynamic lift caused by the vastly-improved lines.

The same shape was used for the sensational new rear-engined 246-Sport Ferrari, an automobile that heralds (we hope) a new design direction for the Maranello firm. This car was near-perfect as it came off the drawing board, requiring only the most nominal adjustments during pre-Sebring testing. It arrived with a final drive ratio that was too high, shown by an inability to reach peak revs on the straights in Wednesday practice, but this was quickly remedied the next morning. Its best practice time, with the ex-G.P. engine of only 2½ liters and 270 bhp at 8000, was 3:13.9 by Richie Ginther. Phil Hill was also near 3:13 with his fully-streamlined TRI/61, which he was to share with Gendebien. The remaining factory TRI/61 had a 1961 tail on a 1960 front-end shape, and was to be handled by Belgian Willy Mairesse and new Ferrari team member Giancarlo Baghetti, an Italian Formula Junior luminary.

Other Ferraris were just as threatening. There were four de Dion-reared Testa Rossas of the 1959-1960 type, one being last year's third-place car of Jack Nethercutt and Pete Lovely — absolutely the most immaculate Ferrari in the line-up. Another was the Le Mans-winning, Nassau-storming car of Pedro and Ricardo Rodriguez, owned by the North American Racing Team of Luigi Chinetti and George Arents and prepared by Chinetti in New York. Hap Sharp and Ronnie Hissom were in another, and George Reed and Bill Sturgis in the last.

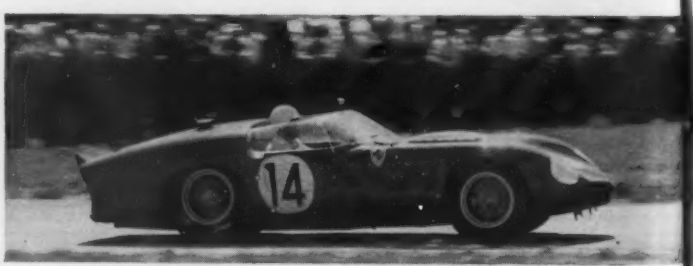
Then there was a clutch of single-cam Dino V6 Ferraris. One was a two-liter, entered by N.A.R.T. and driven by Skip Hudson, Bill Helburn and John Fulp. It ran with a taped nose after being dropped off a truck on Wednesday. The other two were 2.4-liter Dinos, one with normal bodywork being handled by Ed Hugus and Allan Connell, and the other being one of the mobile testbeds for Ferrari's new streamlined shape. It had the fastback of the factory cars but not the divided nose, and was capably handled by Jim Hall and George Constantine.

There was, with reason, less confidence in the Maserati camps. No Birdcage had finished last year and two of the six cars this year were the unraced rear-engined Type 63s, one for Cunningham and one for Camoradi. Momo's car was Alitalia-shipped from the factory March 10 and picked up March 13th, leaving Alfred about four days to prepare the car before trucking it south. He did as much as he could in that time — improving the fuel system, wrapping the tanks in fiberglass, painting the front of the cockpit flat



Trips almost abandoned the rear-engined Ferrari after its steering broke, but then decided to drive it out of the airfield and back to Ferrari's pit.

The Rodriguez boys flung their Testa Rossa around like a Sprite, as here with right-hand lock on the left-hand corner just before the road section.



Lines of the winning Ferrari are sleek, striking. They're also efficient, with a high tail cut off suddenly at the back in accord with Prof. Kamm.

Leading typical Sebring traffic into the Esses are the squat Begra, on the left, and Walt Hansgen in Cunningham's rear-engined Type 63 Maserati.

black – but more time would have helped. Matters seemed even worse with Camoradi, which was preparing its car at the track.

Both Type 63s were much refined from the prototype (C/D, April, 1961), especially in front-end structure and dashboard. Even so, Moss definitely didn't care for the Camoradi car he and Graham Hill were set to drive, so they changed to Casner's new (22nd and last built) Type 61 Birdcage. Walt Hansgen was not much happier with his and Bruce McLaren's Type 63, but he managed to lap as fast as 3:17 and stayed with the car. Even so he was timed by Bertocchi at 3:17 in Thursday *night* practice with the old Type 61 he raced at Sebring last year and all through 1960. This car was being driven by John Fitch and Dick Thompson. After the Moss switch, the Camoradi Type 63 was to be driven by Masten Gregory, Lucky Casner and a lineup of other hopefuls including Lee Lilley. The last Maser was the littlest, the two-liter Type 60 driven by Briggs Cunningham and Bill Kimberly.

Among the Porsches were two factory cars, clearly after first place overall with their 1680 cc displacement. One was driven by Hans Herrmann and Edgar Barth, the other by Joe Bonnier and Dan Gurney. On the latter car the new Energit brake linings weren't bedded in slowly enough on Wednesday and as a result wore down amazingly fast during Thursday practice. Thursday night's session was spent bedding in a new set. Among the other Porsches four cars were 1590 cc (Pabst/Wuesthoff, Bradley/Ryan, Donner/Sesslar, Cassell/Lane) and only one was under 1500 – the Brumos-entered, Continental-tired RS61 of Bob Holbert and Roger Penske.

Other makes were well represented, though not in contention for overall honors. Teams were on hand from Alfa Romeo, Lola, Abarth, Aston Martin, MGA, Sprite, Elva, Sunbeam Alpine, Triumph, A.C. and Arnolt-Bristol. There was also the little metallic-blue Begra we reported on last April, fraught with development problems with a brand-new car. First the cooling wouldn't work, until a newly-installed bypass of the water-circulating pump was removed. Then the exhaust system started cooking the fiberglass body. A more compact straight pipe was fitted but this caused a loss of 1000 rpm, so a new expansion chamber was fabricated outside the tail section. An exasperatingly balky shift was blamed on the gearbox linkage and finally traced to a split clutch disc facing. With all their difficulties Henry Grady, Gene Beach and John Bentley never had a chance to cut a fast lap in practice.

This was the background when the cars were arrayed at 9:45 a.m. on the hot concrete that is Sebring. Weather was perfect, as it had been all week, and a crowd estimated at between 12,000 and 40,000 (depending on whom you talked to) was on hand. The drivers sprinted cleanly in the silence of the 10 o'clock flagfall and vaulted high into this year's deeply enclosed cockpits. The field was away fast and packed

PHOTOGRAPHY: SCHULKE

How pylons get smashed! In the second-place team Ferrari, Baghetti cuts deep inside the non-finishing Alfa Romeo Zagato coupe out on the airport.

solid, with no standout leaders. Some were away late: Jim Hall in the Dino Ferrari, Briggs Cunningham in the Type 60, Henry Grady in the Begra, and Stirling Moss – even later than last year because the battery was too weak to start the car. Six minutes passed before a new one was installed and Stirling started, leaving him hopelessly behind and not gaining on the leaders. After Graham Hill took over, the Camoradi Type 61 retired with a broken exhaust system.

The first-lap leader, by a decisive margin, was Masten Gregory in the Type 63 Moss had turned down. Next were Pedro Rodriguez, Pete Lovely and Walt Hansgen ahead of Phil Hill in the first factory Ferrari. Ginther was back in seventh in the rear-engined car. Pete Lovely went literally smoking into the pits after his flying first lap. The engine was inexplicably pumping oil out the breathers, indicating the scavenge pump wasn't scavenging, but after the pan was pulled an hour later no derangement could be located and the Nethercutt entry was finally scratched at 12:30.

Behind Gregory it seemed Rodriguez would have to fall back at the G.P. pace being maintained, but the opposite happened and Pedro took over first on the fourth lap. In a bunch with those two were Phil Hill and Walt Hansgen, now in that order, followed at a distance by Ginther. At that point Phil was committed to a conservative (for him and Olivier) pace for the first six hours, while Richie was following a lap time pattern of about 3:17 that left him moving up ever so gradually on Phil. Both Gregory and Hansgen showed the Type 63 to be much more in contention than expected, Walt seeming to warm to the car while Masten faded gradually back, being passed by Phil at 10:15, Walt at 10:20, and Richie at 10:25. The car had fallen back to ninth – behind Jim Hall – at 11:50 when Masten hurtled into the pits and earned a one-minute penalty for excessive speed from alarmed officials. This was of little importance for Lucky Casner now took over, then gave the car to unemployed Moss at 12:45. By 1:30 the disintegration of the soda-straw frame, already begun, was completed and the car withdrawn. End Camoradi.

Still moving at his smooth rate with an occasional 3:16 lap, Ginther passed Phil Hill and finally moved by Pedro at 11:10 to take the lead. He continued his pace until he received the "OK" sign, then leveled off to hold first slot without difficulty. Noon came and with it the multiple driver changes that marked the end of the official Grand Prix (winner: Ginther) and the beginning of the endurance battle of pit stops and lap charts. Ginther handed to Trips, Pedro to Ricardo, Hill to Gendebien and Hansgen to McLaren, the rear-engined Ferrari keeping the lead in the process. Gendebien would not have an easy time, for his left ankle was badly twisted on Thursday during horseplay in the pits. Had it been his right foot he could not have driven, for the Ferrari's non-servo disc brakes require shin-busting pressure. As it was he was "too excited" during the race for the ankle to bother him.

Mechanical ailments were already legion. The Hudson/Helburn/Fulp two-liter Dino developed a slipping clutch

and a sick rear end but was nursed through to finish first in class ahead of the Cunningham/Kimberly Type 60 Birdcage, which spent vast time in the pits in search of an engine ailment that turned out to be a faulty coil (same problem: Ross/Hall Lola) and couldn't catch up in spite of some night lappery by Walt Hansgen. Right from the start clutch slip hit the Gurney/Bonnier Porsche, causing the engine to rev uselessly "whenever we went to pass an MG or something." Carbon tetrachloride didn't cure it; the car was retired at 4:50 p.m. and the team switched to the other factory Porsche, which obliged by breaking a camshaft and officially retiring at 6:50.

Among the wee ones was the Manley/Hanna DB, which had a brand-new engine using an entirely new cylinder head design, still with pushrods but with coil valve springs instead of the old torsion bars, and with twin ignition. Sadly it dropped a valve (too experimental?) and was retired at 2:10 after a valiant attempt to get it running out on the course. After its late start the Begra suffered several stops, then had to stop out on the course at 3:15 p.m. with engine trouble. Builder Gene Beach walked home.

Wolfgang von Trips was still holding first with the remarkable rear-engined Ferrari but was apparently using bumpy sections of the road to do it, for at 1:20 he lost steering control to the right front wheel on a very fast left bend and spun well out into the airport greensward, mowing down rubber pylons in the process. The lower right wishbone was found to be bent and the tie rod was broken clean off at the inner end. Trips drove the machine back to the pits where it was retired, leaving the fast Rodriguez Ferrari in the lead, ahead of Hill and Hansgen. Team manager Tavoni decided to put the Trips/Ginther team in his remaining front-engined Ferrari, and Richie went aboard at the regular 2:15 stop. By some Modenese mischance the other team car was called in at the same time, and it had to wait its turn after the Ginther car was serviced, with only one squad of mechanics available. The same thing happened at the next Hill/Gendebien stop at 3:50, handing over an even greater lead to the Rodriguez car which was being dealt with expeditiously in the pits.

The two factory Testa Rossas were a handful, for the engines have been tuned to an impressive peak to the detriment of the rest of the power curve. Both cars were so bad low down that first gear had to be used at *six* corners around the course to keep them from sputtering and choking. Hill had been disconsolate about the carburetion of his car from the beginning of practice but apparently nothing could be done. In spite of this Phil was down to 3:15-16 while chasing Pedro Rodriguez in the afternoon. Phil was utterly exhausted by cockpit heat when he came in for the 3:50 change-over, but his intense determination had kept him from slacking the pace.

Bruce McLaren took over the third-place Cunningham Type 63 Maser at 3:33, and almost immediately thereafter was seen to be pouring smoke out the back. The gearbox casing was broken and leaking lubricant which ultimately vanished, freezing up the box and causing a small fire which Bruce extinguished, then left the car out on the back airport straight. This was the next to last of the big Masers, since the Fitch/Thompson Type 61 had halted before 1 p.m. with a broken final drive. Unfortunately not even the presence of factory chief mechanic Bertocchi in the Momo-Cunningham pit could extend the Type 63 past the half-way point. The Causey/Stear Type 61 was the last to go at 6:10 p.m., with number two rod through the side of the block.

Still holding the lead through 6:00 were the Rodriguez brothers in their normal-looking Ferrari which Richie Ginther described as "kind of a special built by the factory — and a darn good one!" They were fairly flying in this machine, taking the fastest bends on opposite lock yet making no mistakes and turning in an immaculate, polished, professional performance. No matter which brother was driving your watch always seemed to show a time between 3:17 and 3:19. They were keeping the race average well above the 1958 record speed, setting the pace that left so many broken Maseratis in their wake.

Thus it was all the sadder that about ten minutes before seven Pedro came into the pits with one headlight out and a lack of charge. Work on the electrical system took time, time and more time, and it wasn't until 7:05 that Ricardo blasted out of the boxes and began what proved a fruitless fight for the lead. The tenth and eleventh hours of the race passed without major drama, as the Sharp/Hissom Testa Rossa moved up into fourth place and the Holbert/Penske Porsche into fifth. This 1500 cc car was an easy leader on index both then and at the finish.

At 9:22 Olivier Gendebien brought the leading car in for a 58-second stop to hand over to Hill; 50 seconds were needed for the Trips-Ginther changeover at 9:29. At 9:30 Holbert made a heart-stopping pit call with a rough-sounding engine but was soon back on the track running fine. As the finish drew near the rolling wounded were urged into life: the Dee/Calhoun Abarth 1000, its engine miraculously rebuilt at the pits; the dim-lighted Sprinzel/Hawkins/Simson Sprite coupe; Skip Hudson in the thrashing Dino and the Red Vogt Corvette entry, which had to be pushed across. After Jesse Coleman waved the checker Richie Ginther went into victory lane by mistake, but was soon followed by Hill, who was joined by Gendebien and Miss Sylvia Belcher, Queen of the 1961 Sebring 12-Hour Endurance Race (34-22-35).

The Hill/Gendebien pairing is certainly formidable. With Ferrari it won Le Mans in 1958 and Sebring in 1959 and 1961, and Phil and Olivier contributed to Sebring wins in 1958 and 1960. Without doubt they deserve to be ranked as one of the finest endurance teams in the history of sports car racing. The Ferrari twelve, of course, is such an old pro at this kind of thing that its victory hardly draws comment. One car may well displace it, though: a stumpy sports-racer from the same shops, with its Grand Prix engine in its hip pocket. —*KEL*

SEBRING 12 HOURS OF ENDURANCE

March 25, 1961

OVERALL:

1.	Hill/Gendebien	Ferrari	
2.	Baghetti/Mairesse/Ginther/Trips	Ferrari	
3.	Rodriguez/Rodriguez	Ferrari	

INDEX:

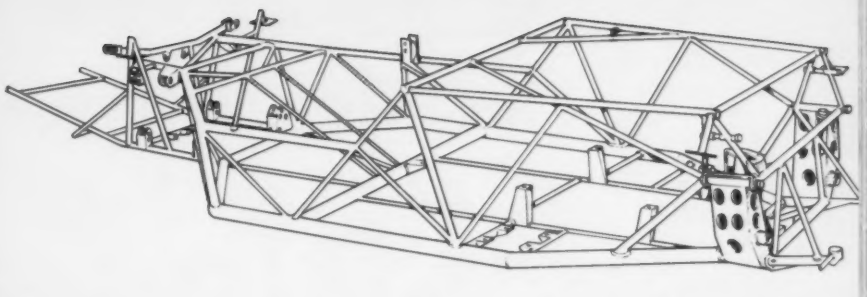
1.	Holbert/Penske	Porsche	1.4636
2.	Donner/Sesslar/Erickson	Porsche	1.4518
3.	Peck/Hoffman	OSCA	1.4031

CLASS WINNERS:

Sports 5	Peck/Hoffman	OSCA	
Sports 6-7	Kurtz/Ripley	Lola	
Sports 8-9	Holbert/Penske	Porsche	
Sports 10	Helburn/Fulp/Hudson	Ferrari	
Sports 11-12	Hill/Gendebien	Ferrari	
G.T. 7-8	Swanson/Durant	Alfa Romeo	
G.T. 9	Parkinson/Flaherty	MGA	
G.T. 10	Durbin/Goldman	Arnolt-Bristol	
G.T. 11-12	McCluggage/Eager	Ferrari	
G.T. 13-14	Johnson/Morgan	Corvette	

Both very fast: Ricardo above, Pedro below.

Olivier Gendebien discounts his damaged ankle.



Above is the space frame of the winning Ferrari. Below Ginther reports after a driver change.

1
Meister Brauser

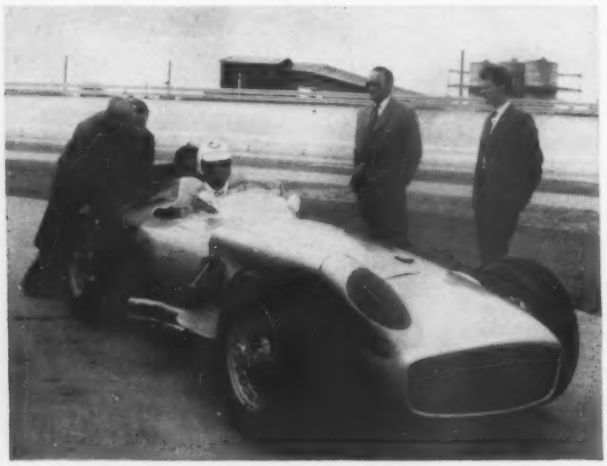
AUGIE'S ALWAYS READY TO WIN

by Steve McNamara

Shades of the Roaring Twenties, "Beer Baron" Augie Pabst makes his fast getaways in an ex-Reventlow Scarab, but he drives for the "wrong" brewery.

► Augie Pabst is a lean, handsome young heir to a milk and beer fortune with a winning smile, an engaging manner and a warm appreciation of good food, drink, clothing and other amenities. He has spent much of his brief racing career driving, open-mouthed, for the "wrong" beer factory in a Scarab, one of the most glamorous American sports cars ever built. In 1959, three years after he started racing, he won the United States Auto Club's road racing championship. Quite naturally, August Uihlein Pabst, 27 (Ed. Note: born November 25, 1933) has attracted a great deal of attention.

Most of the attention Augie enjoys; some of it raises his hackles. What "bugs me a lot," Augie says, is comment that he's just a preppie in a fast car who has greased the skids to victory with a lot of beer money. "Half the time, I'd like to change my name." Ironically, the more knowledgeable the racing figure, the less one hears that sort of comment. Alfred Momo, the mechanical maestro who manages Briggs Cunningham's racing team, considers Augie one of the most promising drivers in the country. "He has impressed me a great deal," Momo says. "He does a very good job with the Scarab, and that is not an easy car to handle." It's hardly surprising that Augie has sparked some grumbling, much of it exuding the aroma of sour grapes. What is surprising



At the invitation of the Mercedes factory in 1960, Augie experienced "one of my biggest thrills," driving the Type W196, above and 300SLR.

is that there is so little of it. Credit should go to Augie on two counts: for his driving ability and for his social style.

Competitors have learned Augie isn't merely a stroker out for a few safe thrills to impress the boys at the Hunt Club bar; he has proved that in countless tight corners and traffic jams where the way a man lifts his foot is a sure gauge of his ability and courage. He proved it, for example, in the Pacific Grand Prix sports car race last fall. Laguna Seca has nine turns and virtually no straights in less than two miles — in a Lotus or a Birdcage it's difficult to pass; in a Scarab it's a real adventure. For the second heat Augie started 22nd, behind all but three drivers in perhaps the hottest sports car field ever assembled. At the end of fifty laps he had knocked off 20 drivers, including Jack Brabham, Bruce McLaren, Bill Krause, Carroll Shelby, Joakim Bonnier and George Constantine — all but Stirling Moss.

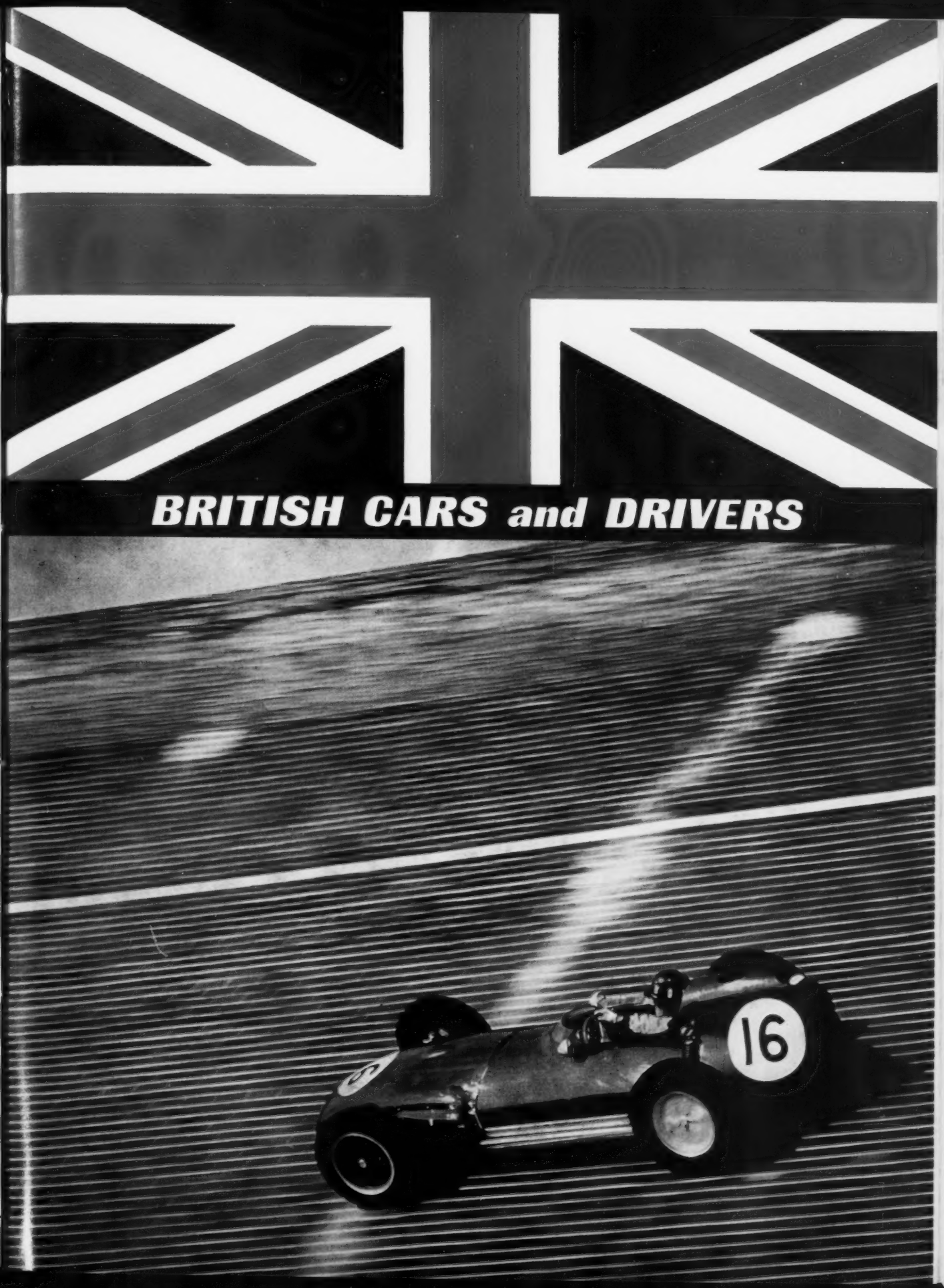
Augie was fighting that windy afternoon because he felt it opportune. "I'll fight a guy," he had remarked earlier, "only if I think it will pay off." This implied ability to limit his aggressiveness instincts is a well-spring of his social success. Augie is a natural driver. He goes fast in anything, and he does it without ever seeming tense, overbearing or aloof — occupational hazards in an often nervous business. He is one of the friendliest persons in motor racing and he seems genuinely interested in almost everyone he knows. Above all, he has the easy grace and civility that in fortunate cases are the hallmarks of someone well brought up on the right side of the tracks, and a long way from them.

Augie is a gentleman. He's also a very successful operative in the cut-and-thrust of professional road racing and as such he bridges the old and the new. When American road racing blossomed in the late Forties and early Fifties it was conducted in the main by and for persons with ample bank accounts. It wasn't unheard-of for races to take place in which maneuvers outlawed as unsportsmanlike included passing in turns. Not surprisingly, results of big bore events often reflected the thickness of a driver's wallet more than his racing ability. Things have changed. Now the front ranks of American drivers are occupied almost exclusively by men like Phil Hill, Dan Gurney and Richie Ginther, who have fought their way to the top with sheer determination and skill. Augie Pabst is one of the very few drivers in America who could do well under both old and new sets of rules.

Augie plays by the new rules, a point on which he is emphatic. "I think I've spent less money on racing than half the guys in it," he says, and quotes some figures which seem to bear him out. Driving a Scarab for the Peter Hand Brewery hasn't cost him a nickel, of course, and a number of nickels have come in. The Scarab's immediate predecessor was Augie's own 2.5 Ferrari which, he says, paid for its keep and then some. His other cars, a TR3 and an A.C. Bristol, weren't profit-makers but the red ink was no thicker than that laid down by many a weekend rally enthusiast.

Augie doesn't worry about the balance sheet but he has his eye on it, an instance where the strong influence of his grandfather can be seen. Augie's father was killed flying for the Naval Reserve when Augie was one year old, and the male influences in his life have been his grandfather and his uncle David. His uncle manages the family business, Pabst Farms, Inc., a large and well-known dairy farm some 30 miles northwest of Milwaukee. Augie himself is a Mercedes-Fiat-Triumph dealer in Milwaukee and lives in the correct suburb with his wife Marcie and his two children, Jimmy, five, and Christy, four. The Pabst family has virtually no control over the Pabst Brewing Company; it was on the losing end of two proxy fights, the most recent of which was five years ago. Augie says he would have gone into the beer business had his family still controlled it, but that not being the case he was pointed toward the farm during schooling at Deerfield and the University of Wisconsin, where he majored in agricultural economics.

Milwaukee is great horse country and Augie learned his lessons with hunters and jumpers. He believes it has helped him some in racing: "In both cases you use your hands and the seat of your pants. And if you try to make a horse do too much with the bit you'll hurt his mouth; that's the same idea as over-revving an engine. But you can't carry the comparison too far. There are lots of things different." The most important lesson Augie learned around horses was a piece of general but strong advice given by his grandfather. "There was one thing he drummed into me. If you are going to a horse show, only go if you are ready to win. The horse must be ready and you must be ready. If there is something wrong, fix it or don't go. You must be ready." This helps explain why, almost unbelievably, Augie has won more than half the races he *(Continued on page 86)*


BRITISH CARS and DRIVERS
16

Driver's Report: ASTON MARTIN DB4-GT

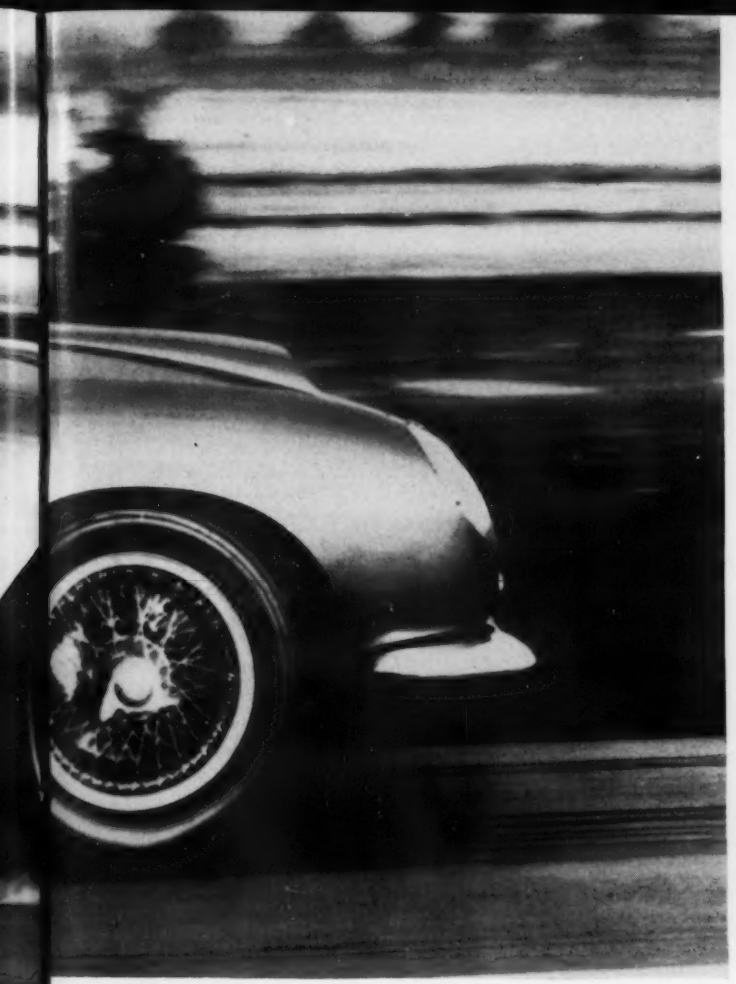
► On M1, Britain's sole and somewhat selfconscious motorway, it's lawful but maybe a bit exhibitionist to pass a police car at 120 mph. So we backed off to a hundred and ten for the few seconds it took to shrink the constabulary Riley to backstud size in the Aston's driving mirror. If the bobbies wanted to ask us for our autographs or anything, they gave no sign.

Combining 331 gross horsepower, respectable aerodynamic shape and as little frontal area as you can reasonably compress within a width and height of 66 by 52 inches, the Aston Martin DB4-GT is Britain's fastest catalogued passenger car. Parochial as M1 is (you've had it in a mite over sixty miles), it's an enlightened piece of engineering, with three lanes per track and short straights alternating with open curves designed as antisoporifics rather than speed abators. So in reporting that on a dry and sunny Sunday, under lenient traffic conditions, we only averaged 107.8 mph for the round south-north-south trip, explanations are in order.

This car, the Feltham firm's resident demonstrator and the only one so assigned, was in a state of semi-convalescence following an engine teardown that had included fitting a new crankshaft. The makers didn't enter any specific mercy plea; on the other hand the *carte* didn't look exactly *blanche*. So we compromised by cruising mostly at around 116 mph, intermittently exploring the 120/130 range, frequently and frustratedly dropping into double figures while our Lucas fanfares penetrated the skulls of abominable slowmen sightseeing in the fast lane, and twice briefly bringing up 142 mph (at 6000 rpm) on the speedometer.

If your veins contain anything more viscous than cold tea, this car's attraction is irresistible. Throw it at a long gradient in third and before you can say David Brown, Esquire, it's slicing the horizon at 108 mph — with another cog still to come. Harden your heart and button your nose against the thought and smell of a clutch in thermal travail and you can gun 'er from nothing to an authentic century in less than a quarter of a minute. Savor the car's uncanny sidebite under limit-crowding lateral g, the huge and seemingly inexhaustable stopping power of the Girling disc brakes, and Roy Salvadori's G.T.-class lap record for Goodwood in last year's Tourist Trophy (89.81 mph) no longer seems impossible but merely improbable.

It didn't take us long to see what Mr. Roy Jackson-Moore, Aston Martin's export manager, had meant when he described the DB4-GT as "an Englishman's car", with the tacit implication that it isn't an American's car. This is not to say it won't sell in the U.S. to a select minority of unAmericans — undoubtedly it will. But here's the point. Assuming cost to be no object, a prospect with serious G.T. racing aspirations will take the even pricier Zagato model's invoice on the chin — and gain the substantial extra performance resulting from 200 pounds less weight and an even lower-drag shape. On the other hand, if he doesn't intend to race and just wants to motor far and fast, in more comfort and with two more seats than the G.T. pro-



If there's no instrument to tell you, the information probably isn't worth knowing. Buttons on dip switch and turn signal flash the headlights.

BENJAFIELD

The DB4-GT sizzles round Goodwood's Woodcote corner at the very limit of its adhesion on a misty morning. Its handling's always neutral.

If you have a penchant for fast driving, cruising at an easy 120, join Contributing Editor Dennis May in the damn-the-economy-full-speed-ahead Aston!

vides, what's wrong with the refined and incidentally much cheaper DB4?

In offering three variations on the same engineering theme, Aston Martin builds a vernier into its sales policy, so to speak: *except* for racing, the noise level in the ultra-light Zagato car is, the makers admit, too high even for most Englishmen. On the other hand, there are those to whom the normal G.T.'s standard of refinement and amenity is quite acceptable as long as a truly brutal performance goes with it. (185 pounds lighter than the DB4, five inches shorter in the wheelbase, and developing an extra 68 bhp gross, the G.T. is around five seconds faster from a standstill to 100 mph, with pro rata gains in the other strata of the acceleration scale.)

This digression disposed of, let's go aboard and see how the DB4-GT looks and feels from indoors. The seats, upholstered in seductively supple leather, are neither too firm nor to squidgy. There's none of the engulfing effect you get with, for instance, Ferrari's deeply bucketed Berlinetta seats, but sufficient side-buttressing to contain and restrain posteriors of a size we don't quite aspire to. For maximum shoulder support the seat backs could be an inch or so higher. The smallish (16-inch diameter) steering wheel, with three mat-black spokes and its polished wood rim enchantingly dotted with alloy dowels, is an *objet d'art* in its own right. In the straight-ahead position it obscures only one instrument (the ammeter, which doesn't matter) and perfectly frames six others, all calibrated in white on black dials: tach, 160-mph speedometer, fuel contents, water temperature, oil pressure, oil temperature.

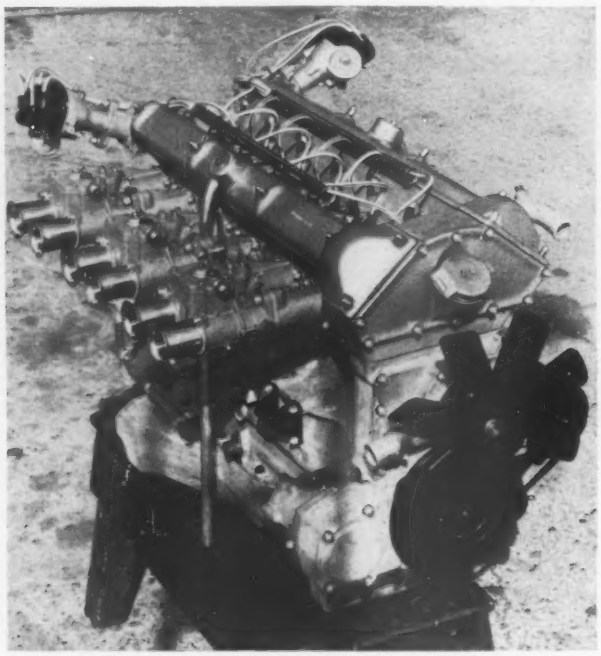
The organ-type accelerator, devoid of rubber or other facing, lines up nicely with the brake pedal for heel/toe stuff. There's a shallow rubber-lined heel well in correct proximity with the pedals, rubber kick protectors on the transmission hump and body lining adjacent to your accelerator foot, and a footrest to slide off onto from the clutch. The short stick controlling the all-synchro 4-speed gearbox is right where you want it, has a short, decisive throw. Make-yourself-at-home aids include fore/aft and up/down seat adjustment, steering wheel adjustment in two planes — in/out and column rake (former allows two fixed settings; both operations need wrenches). Realization that this car's furnishings, controls and instruments were planned by people to whom driving is an end in itself, comes the moment you set Daks to hide.

There's a choice of five axle ratios. If you don't state a preference you get the 3.54 to one gearing that the test car had, giving 22.6 mph per 1000 rpm in top. If you want more acceleration at the price of reduced maximum speed you can opt for 3.77 or 4.09 to one. If you want more speed at the expense of acceleration, 3.31 and 2.93 to one back ends are available, the latter giving 27.3 mph per thousand. This data has obvious relevance to the following acceleration figures that we recorded: zero to 40 mph, 4.0 seconds; to

60 mph: 6.8; to 80 mph, 10.4; to 100 mph, 14.8.

Pre-delivery, says Mr. Jackson-Moore, all DB4-GTs with the 3.77 to one gearing have to get to 100 mph in 14 seconds or less, and most of them vary between 13.4 and 13.7 seconds. In case you think this is a tall story, and assuming it's convenient for you to pay a call on the firm's Newport Pagnell factory when your DB4-GT is undergoing pre-delivery testing, you'll be quite welcome to sit alongside the tester with a stopwatch and have this remarkable accelerative capability demonstrated to you. And if you're specifying the 3.54 to one ratio, he'll oblige with times in the 13.9 to 14.1 band.

The back axle is positively located both laterally and longitudinally, relative to the chassis — inescapably, of course, because coil springs, which are used at the back as well as the front, merely spring and don't locate; also a Powr-Lok limited-slip differential is fitted. The combination of good axle discipline, moderate unsprung weight and the Powr-Lok's traction-promoting properties is valuable under all conditions of vigorous driving but *in*valuable during standing-start getaways: no hop, no judder, minimal wheelspin when the clutch bites home and the power curve really starts reaching for the roof in the 5000-per-minute region.



Rx for performance: take a six-cylinder, 224-cubic-inch engine developing a solid 331 bhp, put it in a DB4-GT chassis for 0-100 in 15 seconds.

Credit is due here, too, to Dunlop's current sports tire, the RS5. This was fitted to the test car but options are Firestone and Avon Turbospeed. During acceleration timings we ran the Dunlops at the 26/28 psi front/back pressures recommended for sub-century driving, increasing to 33/35 for motorway travel. A.M. considers Dunlops give the best traction, specially on wet surfaces, but are inferior to Avons for high-speed tracking.

It's perhaps stating the obvious to say there is nothing much wrong with a gearbox that supplies the leverage for, and stands the brunt of, nothing-to-100 takeoffs in substantially less than a quarter-minute. Our only criticism could be that until you get used to it, the third-top shift has a tendency to momentary hang-up if you follow the normal and prudent practice of exerting oblique pressure away from the first-second side of the pattern. All that's needed to overcome the hindrance is a purely straight-back pull, response to which is as fast and clean a shift as any we've known.

As implied by the reference to centigrade smells from the bellhousing under the influence of blitzen getaways, the test car's clutch was getting pretty well all it had stomach for during the acceleration timings, which would partly account for the difference between our times and the factory's claims.

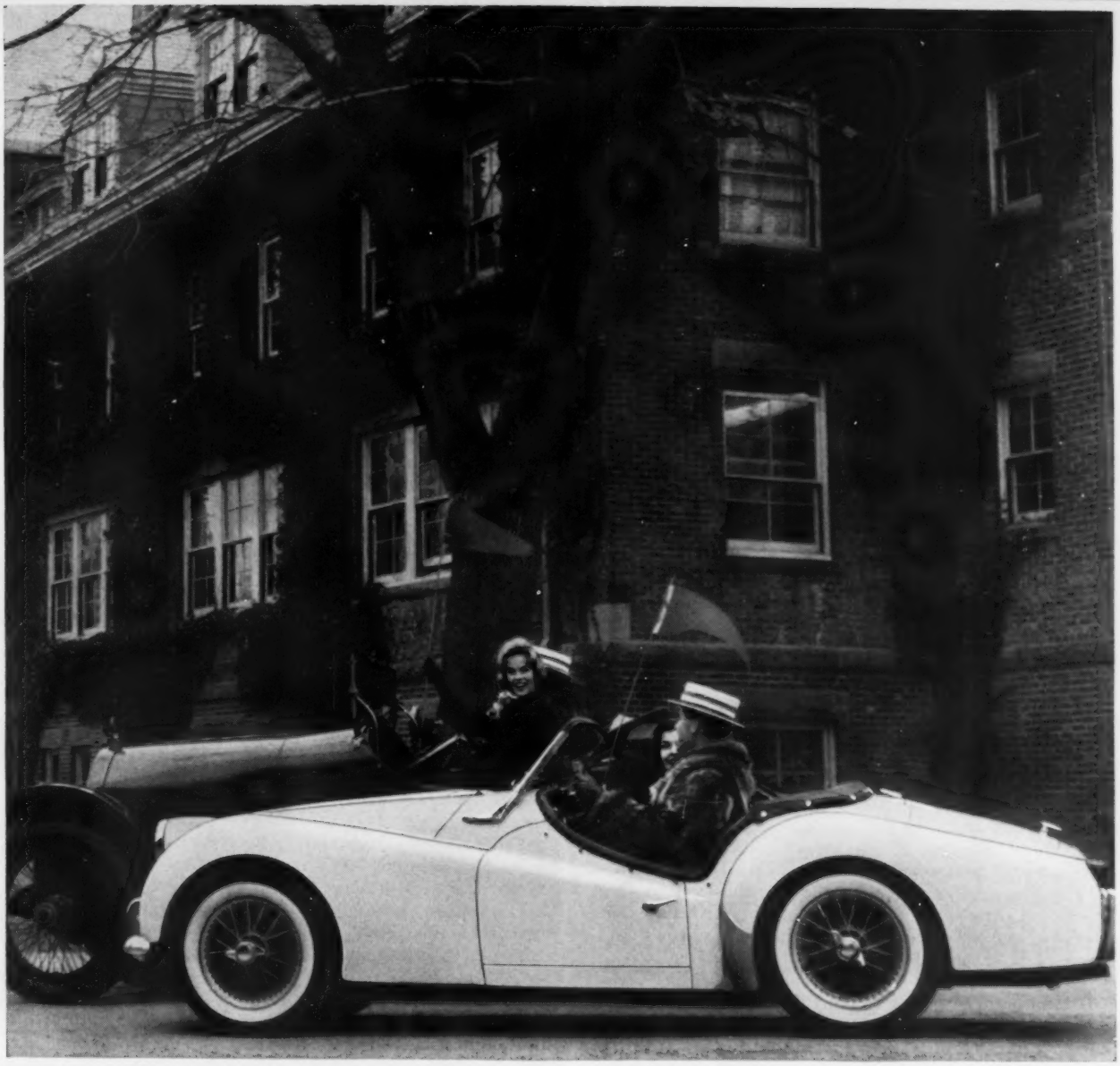
Handled as it likes to be handled, this is a busy piece of mechanism and sounds like it. Get it twisting and it emits a glee recalling Keats's "hum of mighty workings", its elements minor individually but hearty in aggregate . . . a euphony mingling maybe a trace of piston slap with the gossip of twice as many camshafts and timing chains as production V8s boast. Exhaustwise, the G.T. is quiet as racing sports cars go (this was particularly noticeable when Astons of this type traded phons with the G.T. Ferraris in the T.T. last year) but pretty aggressive by average sports car standards. We wouldn't quarrel with that too much if the tail of the twin-pipe exhaust system didn't reduce an otherwise adequate ground clearance to a hindersomely poor one.

At the low idling speed the test car's engine was set at, 500 rpm, the triple twin-throat Webers had the fretfulness and hesitancy that these carbs often evince. Until experience proved the contrary, we wondered whether the condition might portend spark plug extinction by wetting, but nothing of the kind happened. They spit and like it, it seems. Step on these Webers and they take it at a glorious gulp, from any speed.

The makers filled her up before our test with in-between-grade fuel, stating, correctly as it developed, that this wouldn't tax the digestion of the 9.25 to one-compression engine. We nonetheless added a half-tankful of 100-octane before doing the acceleration timings. Knocking couldn't be provoked on either grade, nor any running-on following switch-offs after fullbore driving. The gas tank — capacity, 36 U.S. gallons — shares the trunk with the spare wheel, and there's no pretense that these leave room for anything else. Luggage is amply catered for, though, by a big platform right behind the seats.

We'd classify the Aston's steering as neutral — and more important, *consistently* so. Although in expert hands it eats dust from very few G.T. rivals, as Salvadori's 1960 T.T. performance testified, it entirely lacks the ultrasensitive "mouth" that's characteristic of more esoteric competition machinery. A driver with experience limited to small and stodgy English sedans could step straight into a DB4-GT and not make a monkey of himself. Geared about as you'd expect for a car of this one's *raison d'etre*, 2.6 turns from lock to lock, the steering is initially fairly heavy but lightens progressively as speed rises. We wouldn't ask for either more or less self-centering action; feed-back of road feel through the rack and pinion is perceptible but never excessive. Body roll is well controlled, right up to the threshold of breakaway. If we'd pushed 845XMV more than a degree or two past the angle of roll pictured at the top of page 35, there likely wouldn't have been a car *to* photograph. Just Goodwood landscape.

The Girling disc brakes, like the steering, get their brief term of sluggishness over with when you're going slowly. Anywhere above 50 mph or so they trample inertia to a swift death. Last year, observed and timed by the Motor Industry Research Association, Reg Parnell demonstrated the ability of the DB4-GT to go from zero to 100 mph and back to zero again in 24 seconds. More recently, again officially clocked, he cut this to 20 seconds. We didn't try it personally but it does our English ego good to doubt whether this "Englishman's car" is in much danger of having its feat eclipsed by foreign rivals of comparable rating. Or any rating. —*DM*



Is the TR-3 the Stutz Bearcat of the 60's?

Roarers from the Roaring Twenties still talk about the Stutz Bearcat. It was razz-ma-tazz and pow and wow! It was hot stuff – like the Charleston, ukuleles and raccoon coats.

Runs there a car like that today? Whoopee on wheels? Over 50,000 Americans – including many who weren't even born in the Twenties, but roar nonetheless–say "Yes! The Triumph TR-3."

The TR-3 is as different from most cars on the road today as the Bearcat was from the Model-T. You know it from the minute you start off. The 4-speed gear shift puts you back in control of the car. And the engine is ready for anything you have in mind... up to 110 m.p.h.

The Triumph TR-3 has probably won more silverware in more famous rallies in more countries than any other automobile model you can buy today–at any price. It isn't just a sports car. It's *the* sports car of the '60s.

The nice surprise is that it's so sensible. It drives easier than most standard cars–and with no need for power assists. It gives up to 35 miles per gallon. It is superbly comfortable with contoured, leather-upholstered bucket seats and room to stretch your legs out. It has space for an optional rear seat. It has a trunk that locks. The styling is not about to change.

And it costs only $2675–hundreds of dollars less than a "low-price-three" convertible!*

The growing network of over 550 Triumph dealers from Maine to Hawaii invites you to test drive a TR-3 – free. Put down that ukulele and visit the dealer near you now.

PLEASANT P.S.: Also try the Triumph/Herald Convertible. Get fine Triumph engineering in a convertible for less than many compact sedans cost.

TRIUMPH

*P.O.E. plus state and/or local taxes. Slightly higher in West. Overseas delivery available. Standard-Triumph Motor Co., Inc., Dept. F-61, 1745 Broadway, N.Y. 19.

Contributing Editor Griff Borgeson puts the watch on a deceptively fast befendered Grand Prix car, a prototype of great road machines of the future.

► The day before Dan Gurney was due to fly to New Zealand to drive for B.R.M. we convened at Riverside International Raceway. Also present were Dan's enthusiastic father (with a new Honda 'cycle in his station wagon), mechanic Bill Fowler, photographer Lester Nehamkin and a very rare and choice sports car, the Lotus XIX owned by Frank and Phil Arciero, general contractors and flat-out racing men of Montebello, Calif. Purpose of the get-together: get acquainted with the Birdcage Cleaner.

Sports cars usually are derived from road machines. While flaying the British sports car industry for its archaic chassis designs John Bolster recently said in AUTOSPORT, "The prospective sports car owner is a man who knows his stuff, and if you offered him a car with chassis features that were straight from Grand Prix designs, he would never again touch the old cart-sprung horrors."

The Lotus XIX's greatest significance is that it is a prototype of the kind of superior sports car that, with a few economy-dictated changes, can and should go into volume production in the not-distant future. It *is* the Lotus G.P. machine, slightly modified.

The car is 31 inches high and an inch short of 12 feet in length. It weighs about 1250 pounds ready to go and with the 152-cubic-inch, 240-bhp Coventry Climax FPF engine has a weight to power ratio of just over five to one. This favorable state of affairs is, of course, just the starting point for chassis wizard Colin Chapman.

The Arciero brothers purchased their XIX specifically for Gurney to drive and Dan put in time at the Lotus plant (the botanical allusion is irresistible) during which he specified assorted minor design changes as the car was being built. His first real outing with the machine was in the Times Grand Prix for sports cars held at Riverside last October. He took three laps for qualifying: one starting lap, one timed lap, one for slowing down. The timed lap was a fairly good one but, since it was the first time Dan had been able to stand on it, it was a bit sloppy here and there. Result: a new lap record for sports cars of 2:00.9.

Gurney was clocked at 156 mph down the back stretch which, with 4.11 cogs, is the limit for the Climax, which is all done at 6800 rpm. There were faster cars on the straight, with times all the way up to the 170s. Nevertheless the new Lotus got through the corners so rapidly and effortlessly that it had the best overall lap time, hands down. "It was no particular driving feat," says Gurney; "it was just the car."

Next came Laguna Seca. During practice Gurney was within one or two mph of the Scarab that had the fastest *trap* time and, unofficially, Dan turned the fastest lap times. Then all eight of the flywheel cap screws sheared and, while there was miraculously little damage, racing was ended for Gurney for that weekend.

Then came Nassau. There, there were a couple of Chev-powered specials that would out-accelerate the Lotus on the straight. But the moment there was a combination of turn and straight the Lotus flashed out of sight. The Nassau course is incredibly rough and, knowing that anyone who goes gung-ho there is begging for disaster, Gurney saved his car and drove to finish. In spite of the soft pedal Gurney won the 250-mile Nassau Trophy Race along with $10,000 and, in the process, effortlessly raised the race record by a full two mph to 89.54 mph.

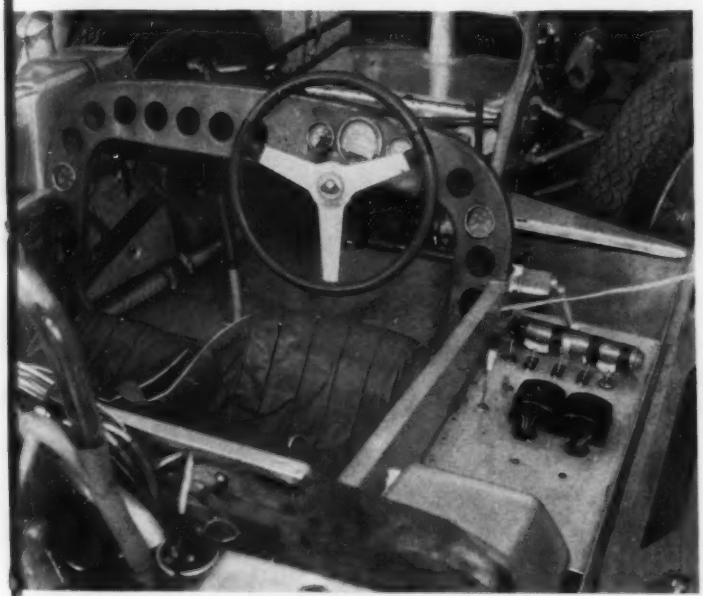
So we went motoring at Riverside. The Lotus XIX is a razor's edge exercise in stress anaysis and its ring and pinion gears, for example, tolerate very little rough usage. It is therefore the Arcieros' rule that no one but Gurney drives the car. I am a very poor passenger under normal conditions but quite cheerful about entrusting my safety to great talent and it was a memorable privilege to ride *copiloto* to the tall, shy but warm Californian.

First I'd like to comment on Gurney's style. I've ridden with Moss, Miles, Ginther and many others and never have witnessed smoother cockpit performance. It is consummately, ultimately smooth and beyond that I'm at a loss for words. At terrific speed he laps a road course not in a succession of acts connected by transitions but in one act which is a flowing continuum. A very nice driver indeed.

Now for the car. It doesn't feel terribly fast on the straight; there is not a sensation of brutal acceleration. Its performance is markedly sensitive to the load of fuel it's carrying, a way of saying that its endowments of power and torque are not fantastic. The accompanying acceleration curve (Gurney alone aboard, driving and operating stopwatch) shows what the car does aside from subjective impressions. Fragile ring and pinion or not, Gurney made the XIX perform like a fairly sudsy dragster and it did not

Many laps of Riverside were turned with Borgeson as intrepid passenger. Prime impressions were of smooth performance of Gurney and the lusty Lotus.

Griff and Gurney check out times posted by the Lotus, which Dan drove "like a fairly sudsy dragster" in spite of fragile ring and pinion.



Stark cockpit shows Grand Prix car frame layout expanded to fit driver and passenger. Big positive-stop shift lever is at left of the wheel.

PHOTOGRAPHY: NEHAMKIN

protest in the least.

Handling and roadability of course are the car's strongest points. They are not absolutes since all depends on how the chassis is adjusted and practically everything is adjustable: camber, toe-in, damper settings, riding height, gear ratios, tire pressures. You can pretty much make the car do what you want and can tailor it to cope with a broad range of conditions. At Nassau Gurney and Fowler were concerned about front-tire wear on the rough, abrasive course and therefore set the chassis up to oversteer slightly, to plow less at the front. This probably was unnecessary since, after about 350 miles of practice and racing, the remarkable new Goodyear Sports Car Specials had lost only 1/16 inch of tread.

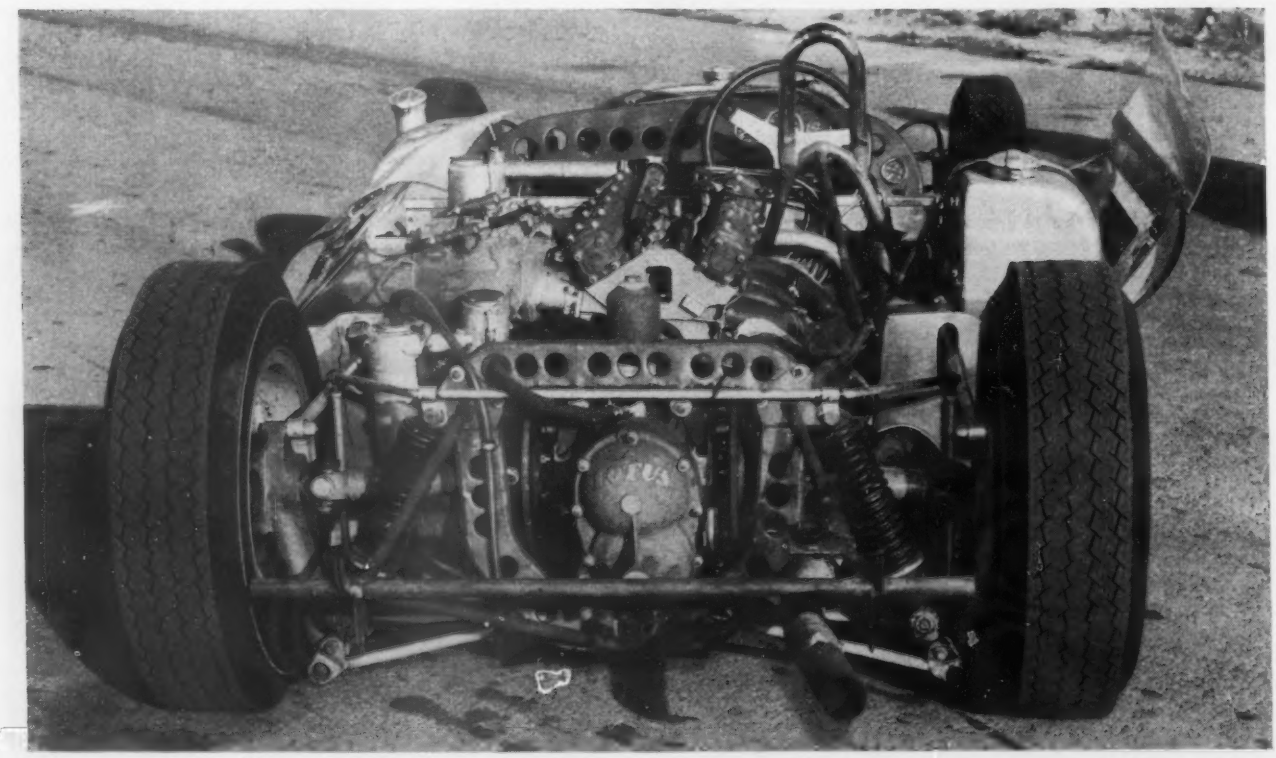
Normally — as at Laguna Seca and Riverside — Gurney likes to have the machine set up for pretty neutral steering tendencies. He has driven almost everything and states that when the chassis is properly set up it is one of the easiest, best-handling sports cars in the world. Some of the Birdcages and Porsches go around corners admittedly well and the Cooper Monaco is very good: none of them are any better than the XIX. In fact, Gurney says that while the XIX still is not a G.P. car in handling it approaches that status closer than anything he has driven in the sports car line. It's just a total pleasure to drive.

The passenger senses this strongly both on the straight and in the turns (he sits in the wind with no seat belt and little to hang on to). Diving down the hill and whistling over the Riverside back straight at 150 mph the ride is like that of — I have to say it — a Cadillac. It utterly puts to shame the typical American straightaway machine, to refer again to "cart-sprung horrors." In the turns, large or small radius, it sticks fantastically and stays dead flat. You can't believe that such side-bite is possible yet there it is, happening.

And now we come to the subject of the rear engine or, as is now more fashionable, the center engine, and its effect upon handling. Since the days of the G.P. Auto Unions it has been axiomatic that a car with its engine behind the driver is inherently squirrelly, that it's a dangerous layout because by the time you sense that the rear end is breaking loose it's already swung around in front of you. Hardly anyone bothered to regard John Cooper's F.3 machines as legitimate automobiles and the Auto Union-based concept or prejudice endured. And out of Cooper's rear-engine F.3s evolved today's fine English G.P. cars and the Lotus XIX.

Dan clocked the times solo during acceleration runs. Built under Gurney's supervision, the Arciero-owned Nineteen varies from "stock" in many details.

Mechanic Bill Fowler stands by as Gurney disdains the door while boarding the Lotus. Automobile demands and gets extremely meticulous maintenance.



Positively packed with machinery, the bared back end of the Lotus shows the compact gearbox and coil suspension. Crew uses Goodyear racing tires.

From what has been said here already it is clear that the XIX isn't just as good as any front-engine car. It's one of the very few best-handling sports cars ever built, one of the easiest to drive. Swooping around big, fast Turn Nine at Riverside at immense speed you can feel the threshold of rear-end breakaway approaching. It comes on very slowly and you have all the time in the world to back off, in which case bite immediately returns to optimum — or to keep your foot just where it is, in which case you continue around the turn with the rear end hanging out a bit. The point is that you get *plenty* of message from these cars.

That was the big problem that had to be conquered before the rear- or center-engine race car could become a thoroughly practical proposition, and it has been conquered. There are many beneficial side effects. One, as Phil Hill has pointed out, is that a driver seated amidships is tossed from side to side during cornering far less than is a driver who is seated closer to the extremities of a vehicle and therefore must devote a lot of his energy to merely hanging on. Another virtue is that with the engine behind the driver there is very little noise to fatigue him. And, from the design standpoint, consolidating engine, transmission and final drive into a single unit is a more economical procedure in every sense.

The Lotus five-speed gearbox leaves something to be desired in the slowness with which the spur-cut gears must be engaged. However it has an advantage over other gearboxes in that any ratio can be changed in about five minutes. *A la* Halibrand quick-change the rear cover plate can be snatched off, exposing all the innards of the transmission. This is a well-proved device, having been around since the days of the Lotus front-engine G.P. car. Its placement in the rear-engine G.P. car was as it is in the XIX: aft of the rear axle.

There are variations from car to car in the few XIXs that have been built to date. The 9.6-inch Girling rear discs are mounted outboard on the machine which Moss has been driving; they are inboard on the Arciero car. On standard XIXs there are two one-inch aluminum tubes which run the length of the body from wheelwell to wheelwell. These are for carrying oil and water between radiators and engine and Gurney, distrusting their exposed position, had them moved inboard. The body is fiberglass and has proved to be extremely durable. It can be removed in moments.

One problem with all Climax-engined cars is that the engines are in short supply and parts are not too readily available. At this writing one gentleman has just ordered a XIX without engine. In this vehicle he plans to install one of GM's new 215-cubic-inch "all aluminum" V8s. This is not as shocking a plan as it may appear to be at first sight. The weight of the two engines is closely similar. With a little Chev-type tuning one bhp per cube should be readily available and with a little boring and stroking the cubes can be increased. The engine is relatively cheap and, most important, parts are cheap and more or less universally available. Which gets us that much closer to the volume-produced super sports car.

The nominal cost of the XIX is $17,000, which probably was pretty accurate when the first specimens were being made. Now, with all the prototype-type problems overcome, the price is considerably lower. Chapman originally planned to build only 12 of these cars per year but that was before he had any way of knowing the market that evidently exists for them or how successfully they would perform. Where it all goes is anybody's guess but, to repeat, the XIX is today's blueprint for tomorrow's superior sports car.

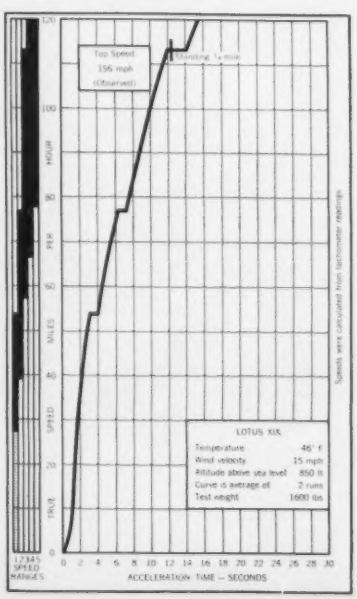
—GB

ROAD TEST:

LOTUS XIX

Price: $15,650 POE East Coast

Manufacturer: Lotus Cars, Ltd.
Delamare Road
Cheshunt, Herts.
England



ENGINE: (Coventry Climax FPF)

Displacement	152 cu in, 2495 cc
Dimensions	Four cyl, 3.70 in bore, 3.54 in stroke
Valve gear:	Gear-driven double overhead camshafts with 0.41 in lift; valves at 66° included angle.
Compression ratio	10.0 to one
Power (SAE)	240 bhp @ 6800 rpm
Torque	212 lb-ft @ 5200 rpm
Usable range of engine speeds	3300-7000 rpm
Corrected piston speed @ 6800 rpm	4100 fpm
Fuel recommended	Superpremium
Mileage	about 10 mpg
Range on 32-gallon tank	about 320 miles

CHASSIS:

Wheelbase	90.0 in
Tread	F 51.0, R 50.5 in
Length	143.0 in
Ground clearance	4.0 in
Suspension:	F, ind., coil, wishbones, anti-roll bar; R, ind., coil, lower wishbone, unsplined driveshaft, trailing arm.
Turns, lock to lock	2¼ (was 2½)
Turning circle diameter between curbs	40 ft
Tire and rim size:	F 5.00/5.20 x 15, 15 x 5; R 6.40 x 15, 15 x 6½.
Pressures recommended	28 psi
Brakes; type, swept area:	disc, F 10.6 in, R 9.6 in; 387 sq in
Curb weight (full tank)	estimated 1250 lbs
Percentage on driving wheels	66%

DRIVE TRAIN:

Gear	Synchro?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	2.50		10.28	—7.7
1st	No	2.50	43%	10.28	7.7
2nd	No	1.75	46%	7.19	11.0
3rd	No	1.20	17%	4.93	16.1
4th	No	1.03	17%	4.21	18.9
5th	No	0.88		3.60	22.1

Final Drive Ratios: 4.11 to one, 4.55 optional.

COVENTRY CLIMAX AND FORMULA ONE

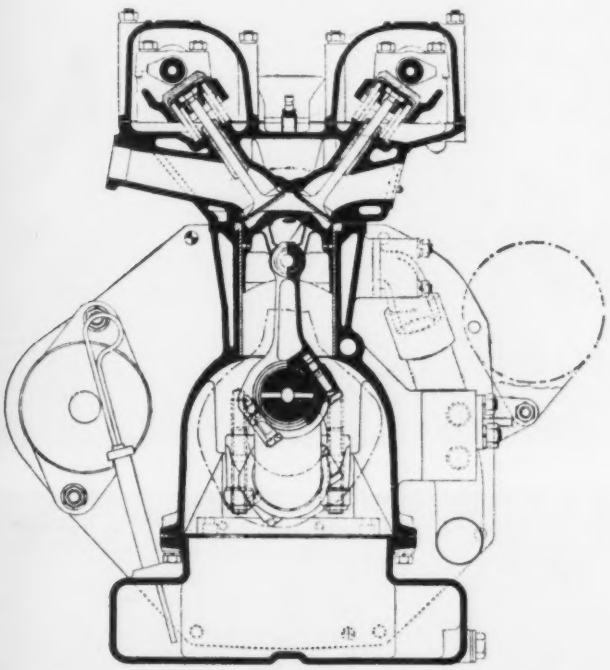
by Jesse Alexander

Harry Mundy (left), engine development, and Peter Windsor-Smith, chief designer, and new 750

This season will be a pivotal one for the English firm that has provided engines for the winners of the last two Championships. Newly-equipped Ferrari and Porsche teams may stand in the way of a hat-trick.

► With Porsche participating in 1961 Formula 1 racing, will the inevitable German-Italian battle completely eclipse the English from their present dominant position? Many people feel this could happen *IF* the new Porsche flat-eight really starts cooking properly from the very beginning. At Maranello, development of Ferrari's latest V6 power unit is behind schedule at this writing but Monaco's May Grand Prix, kicking off the Championship series, will probably see at least one of these engines in the rear-engined Ferrari. One thing is clear, however: Cooper and Lotus are not standing still, nor is Coventry Climax, who is being relied upon by those two English builders to supply them with a competitive 1.5-liter power unit.

The Climax design team of Wally Hassan and Peter Windsor-Smith will rely initially on the 2.5-liter FPF four-cylinder brought back down to 1.5-liter size (3.22-inch bore, 2.8 stroke) until their new V8 engine is race-ready. More about that V8 in a minute, but let's wrap up the four-cylinder first. By using the stronger block for '61 they'll be gaining an extra 500 rpm and Lotus and Cooper rev counters will be red-lined at 8000 this year rather than the 75-7600 which was the ½'s maximum during 1960.



First published cross-section of 750 twin-cam Climax illustrates race potential of small engine. It may be used in Class H specials now being built in the Midwest. A brace of these heads is used on the new V8.

Considerable development has gone into the upper end, with a new aluminum cylinder head just being delivered from Birmingham Aluminium as this is written. It will have circular exhaust ports, 2.5-liter-size exhaust pipes will be standard and a 10 percent flow improvement has already been shown. At present the engines are delivering 153 to 155 bhp but as soon as the new head is fitted it's hoped that another 10 percent in actual power will be forthcoming. More valve overlap is specified with a 302-degree basic valve opening period. But the chief news is that attention to port design and valve gear will give more revs plus more power *and* a considerably improved torque curve.

Two-and-a-half-liter con rods will be standard in the one-and-a-half-liter racing unit and the rugged crankcase with its stiff construction means that these engines should have high reliability. Cross bolts are used on the main bearing caps. In short the Formula 1 Cooper and Lotus cars — and probably B.R.M. — will still be sporting four-cylinder engines, probably for most of the season, until the new V8 is ready for delivery.

This "little V8", as it's called, will be built in two versions: a full-race double-overhead-camshaft 1.5 unit, as well as in 1.6-liter G.T. form with single-overhead-camshaft specification. Any supposition that these two new Climax engines bear any resemblance or relate in any way to the earlier Climax V8 is not valid as was pointed out to me by Peter Windsor-Smith, chief engine designer at Climax. "If our new V8 relates to anything, it's the 750 d.o.h.c. FWMC racing engine; it's not exactly like it but similar in many ways. Naturally we learned a lot from our older V8 but just forget that power unit."

The Coventry Climax V8 is in the pattern stage at this writing. The decision to build it was made in June of 1960, but F.I.A. and C.S.I. Formula wrangling delayed the project. The present timetable expects the first engine to be running by late spring of this year. It will be entirely of light alloy, with magnesium cam boxes, and the weight should be under the present 290-pound figure of the four-cylinder. Birmingham Aluminium is responsible for the casting. So, put together two of these 750 twin-cam Climax units, in a 90-degree vee, fit a dry-sump lubrication system, chain-driven accessories, either a set of downdraft Webers or Lucas port-type fuel injection and you'll have a rough idea of what's in store. It is hoped that Lucas will perfect a new type of transistorized ignition that will eliminate contact breakers.

What Climax is doing, of course, is building a new block and bottom-end to take two cylinder heads from the FWMC 750 cc twin-cam illustrated here. The block of this little four serves also for the milder single-overhead-cam FWM outboard engine and for its FWMA automotive version. Thus the single-cam FWMA head will naturally fit the new V8 block as well — which is where the abovementioned 1.6-liter G.T. V8 can come from! The strong interest of Coventry Climax in this engine series is indicated by the recent redesign (by Doehler-Jarvis engineer Dr. Fred Bauer) of the four-cylinder block to make it suitable for quantity die casting.

Slightly under 200 FPF racing Climaxes have been built in the last two years. Thirty 2.5-liter units have left the shop; prices for these engines are high but so are development and manufacturing costs. Why continue building racing engines at Coventry Climax? Because it's reached the point where success or failure for England in G.P. racing depends in a large part on Climax. John Cooper and Colin Chapman are counting on them and with this exciting new pair of V8 engines in the offing a new chapter is about to be written. —*JLA*

The author is now Director and General Manager of the MG Car Company, and has long been associated with the firm's competition work. His book, MAINTAINING THE BREED, *is the recognized history of MG racing and record-breaking. His comments here provide an unusual insight into the problems of sports car design, and offer a look into the future for students of the frantic art of competing at Bonneville.*

SHAPING for SPEED

by John Thornley

Record-breaking brings far more than glory to MG. Read how the Bonneville streamliners of today may affect the British sports car's shape tomorrow.

► Of recent years the word "compromise" as it is applied to the arts, to architecture, or to engineering, seems to have acquired a disparaging connotation. It is nowadays tacitly understood that in the case of a "compromise" the artist, architect, or designer has sacrificed at least a portion of his ideals, and is therefore something of a poor fish. But nothing has yet been designed, nor is anything ever likely to be, that is not a compromise in some degree. This is particularly true of the automobile.

The manufacturer who sets out to produce a car in which comfort is the first consideration tends to design something which is rather larger than it need otherwise be, not solely because of the increased accommodation that he wishes to offer his passengers, but also because a soft suspension dictates large wheel movement, a wide tread (generally), to provide freedom from roll, and a long wheelbase to provide freedom from pitch. The increased size and weight dictate a larger engine, which in general terms will have a healthier appetite for fuel. And in the end the vehicle will be a good deal more costly to buy and to run than if the insistence on comfort had not been quite so intense.

At the other end of the scale, the designer to whom high performance is the major consideration will cram his occupants into a reduced compass, will limit his wheel movements to keep his fender line low, thereby inevitably providing a harsh suspension, and by screwing large amounts of power out of a diminutive engine may well finish up with something almost as thirsty as a much bigger car. In the interests of rapid acceleration he will reduce weight to the point of fragility, or seriously raise the cost by the use of comparatively rare and expensive materials.

In both the above instances the manufacturer is likely to enjoy a strictly limited market, because he has pushed his ideals to the point where the finished vehicle appeals only to a minority. (*Continued on page 62*)

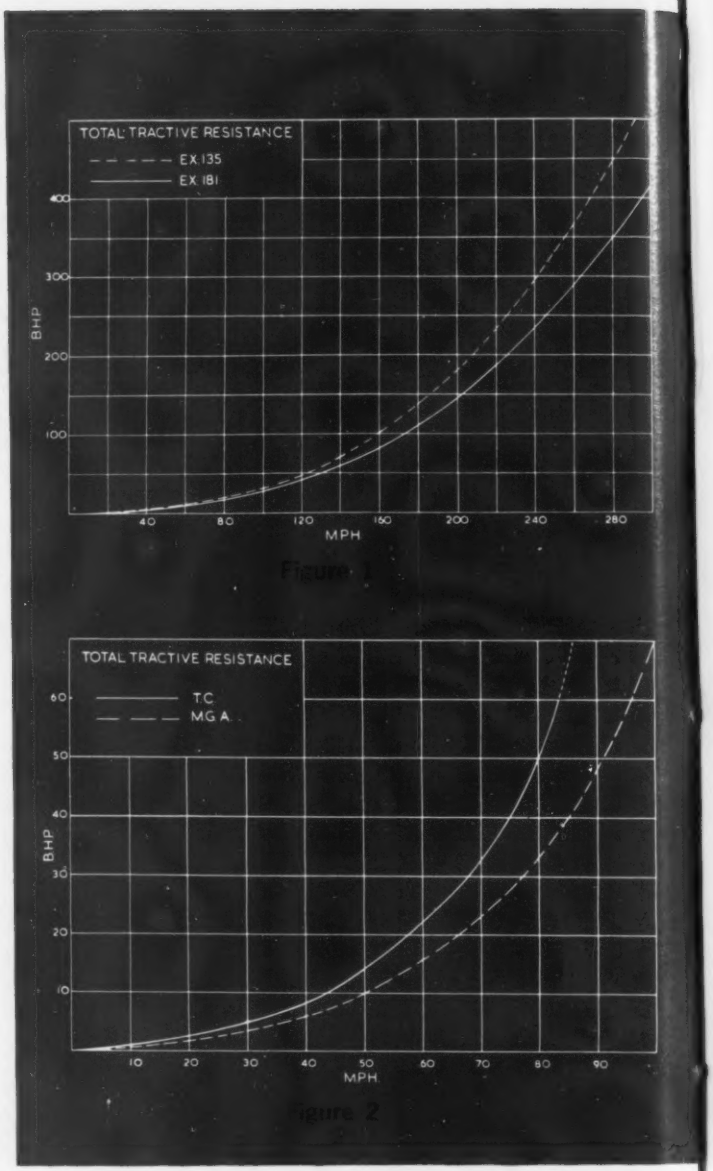
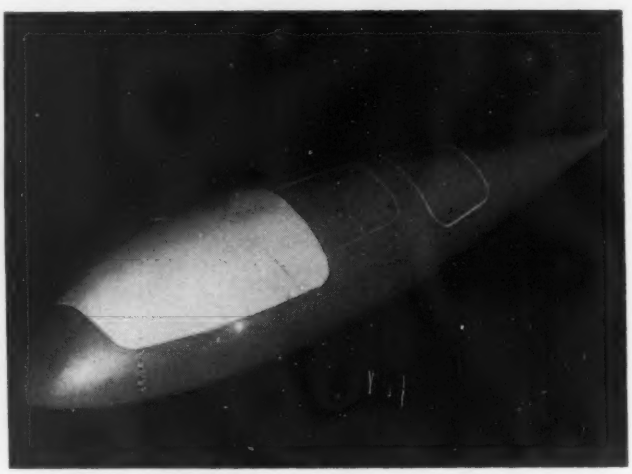
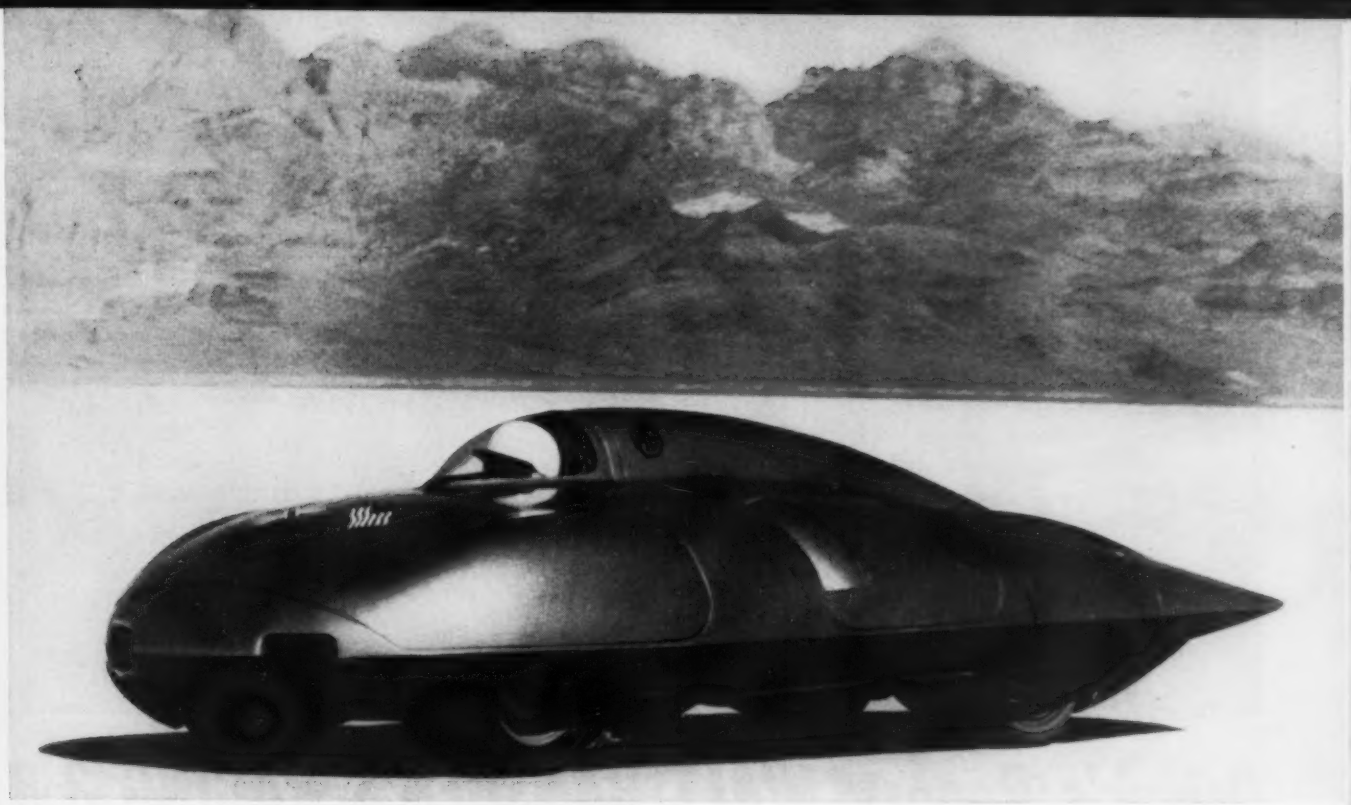


Figure 1

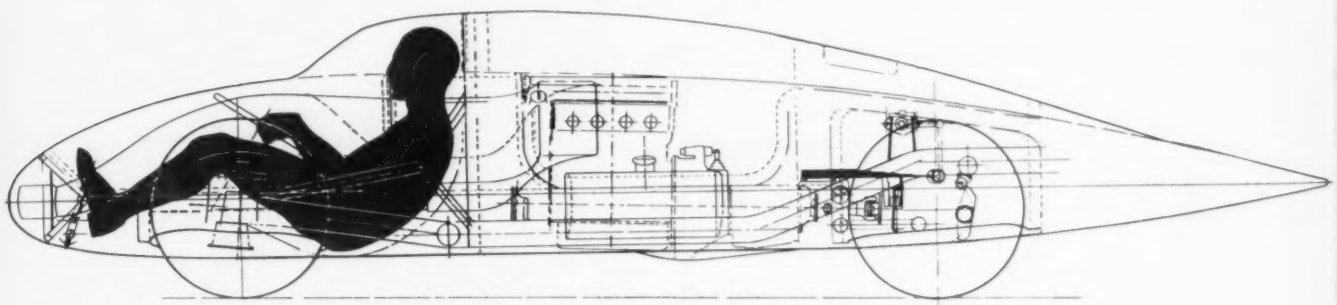
Figure 2

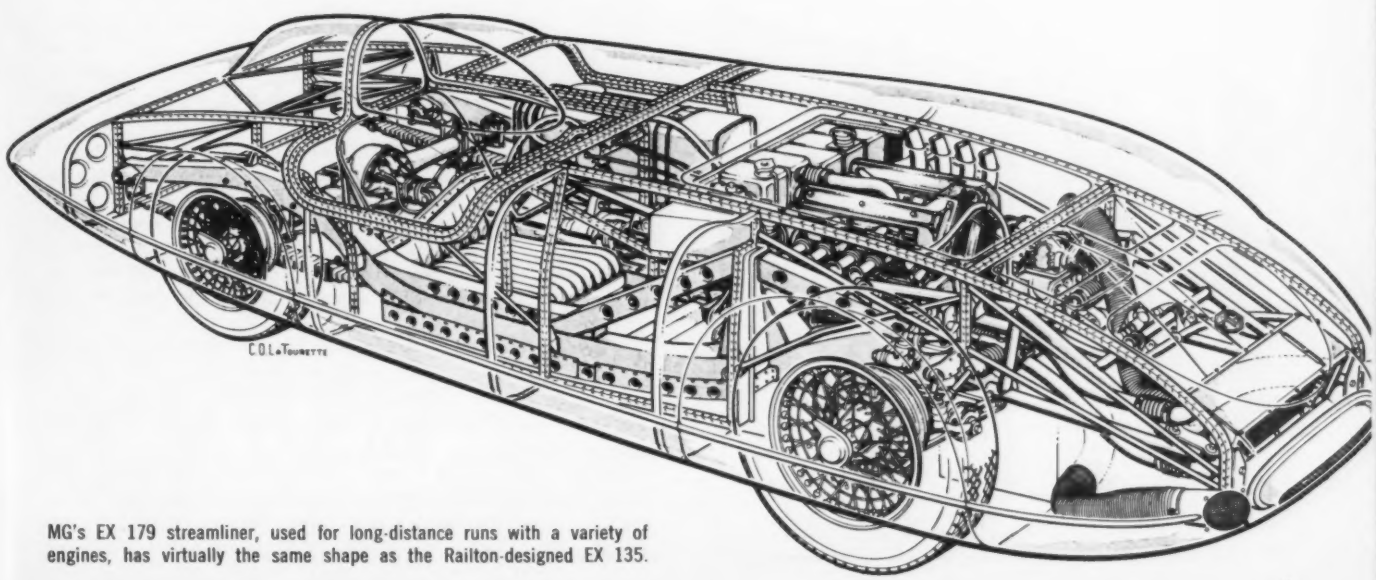


Round-topped, flat-bottomed EX 181/7 shape was investigated for latest record car, but finally deemed too impractical.



In its most recent run at Bonneville, in 1959, Phil Hill drove EX 181 at more than 250 mph. Figure 1 at left shows that about 260 horsepower did the job. Layout of EX 181, shown below, shows choice of a high-ground-clearance configuration. Blown twin-cam engine and de Dion end were employed.

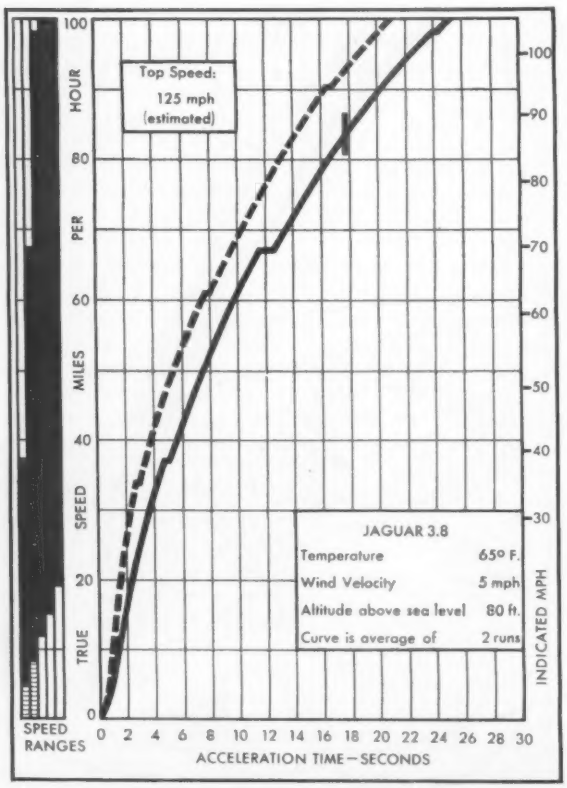




MG's EX 179 streamliner, used for long-distance runs with a variety of engines, has virtually the same shape as the Railton-designed EX 135.

Driver's Report: WALT HANSGEN'S RACING 3.8

Try the above on your family sedan. If it's one of Sir William's compacts you'll be first out of the corner — in a dignified manner, of course.


Top Speed:
125 mph
(estimated)
JAGUAR 3.8
Temperature 65° F.
Wind Velocity 5 mph
Altitude above sea level 80 ft.
Curve is average of 2 runs
TRUE MILES PER HOUR SPEED
INDICATED MPH
SPEED RANGES
ACCELERATION TIME—SECONDS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
0 20 40 60 80 100
30 40 50 60 70 80 90 100

► It isn't every day that we get the chance to drive a race-winning factory-prepared "stock car". And when that day is warm and sunny after a long, grueling winter — well, there are compensations for the hard life lived by the average auto journalist. The car was Walt Hansgen's right-hand-drive 3.8 Jaguar, originally set up by Sir William's merry men for production car racing in the United States. Although a test on a 3.8 was run last September we felt this one was different enough to warrant further coverage. And besides we wanted a good excuse to drive the car!

The questions in our mind were: how stock is "stock", and how much did the changes affect the car? Walt's 3.8 is the same one he drove at Riverside's November meet where he romped the field in the Touring Car race. Unlike our domestic stock-cars-for-racing, it has only subtle changes. No roll-bar cage, no safety hubs or reinforced wheels, only minor changes to the power plant (startling ones at that), an extra 12-gallon tank (which raises the total to 26-plus), and a handsome pair of genuine wrap-around bucket seats.

These seats are impressive in every way. They look well and they hold you well. They may not be easy to slip into, but once you're in, no lateral forces will ever get you out. Their backs curve around extensively in order to get a firm grip on your bottom, but by judicious waist-level cutting-away of the sides, there is ample elbow room as you wheel and deal through the corners. This is the same kind of seat the British use in their sports-racing cars; no wonder they often scorn the seat belt. In the U.S., we too often use the latter to keep from sliding sideways, a job the good bucket seat does on its own.

A second facet of these seats is the confidence they instill in their occupants. Now don't get us wrong, we've all the confidence in the world in Walt Hansgen's driving; what we had in mind was that he never let out a peep while we were driving!

We've seen a fair number of modified engines in our time, but Jaguar's cooked up a modification that startled us. Here's a race-prepared engine that actually puts out *less* power than stock! It's down from (*Continued overleaf*)

MORRIS

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Every one of these fine cars

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comes to you Lucas equipped.

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Ferrari

For peak performance for

ROVER

Vauxhall

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225 to 219 bhp, still at 5500 rpm. It's hardly a world-shaking drop but certainly in the opposite direction from what we'd expected. Torque, on the other hand, is raised an equally small amount from 240 to 246 lb-ft. The big clue is that the speed of peak torque drops from 3000 down to 2500 rpm, signifying that this engine's meant for low-speed pulling.

The main change is the half-ratio jump in compression, from 9 to 9½ to one. That's on the inside; all you can see externally is the much simplified duct which brings fresh air in from the left front and blows it towards (but not into) the two S.U. carbs. The air filter *cum* silencer is omitted and a fishtail nozzle spreads the air towards both carbs.

The 9½ to one compression makes this Jag a bit choosey about octane ratings. It definitely had to have superpremium and even then some brands were inadequate at one time or another. The day we drove it, the air was cool and fresh and whatever was in the tank was doing its job in pleasant silence. Mid-range power was supplemented by extremely good low-end torque and smoothness. In second gear we could pull away from a "rolling stop" without hesitation and even, to prove a point, start from rest.

The latter was avoided as the clutch, still unchanged after the Riverside race, had been adjusted as much as possible and was by then on the ragged edge of replacement.

In view of this we made only two acceleration runs with, of course, Walt Hansgen at the wheel. It was an ear-opening experience and we wished our eyes could have been on Walt's greased-lightning hand rather than on the speedo or the stopwatch. Walt was in and out of those gears so fast, and without a pin drop of gear-clashing, that we could only marvel at his skill. Even the change into second which has, to put it mildly, a somewhat inadequate synchromesh occurred smoothly, silently and faster than a snake's strike.

The takeoff from standstill was determined but not dramatic. There was just the merest touch of wheelspin, the useful kind that means you're keeping the revs up without slipping the clutch rather than a mad, futile churning of rubber on asphalt. The figures we got were impressive ones but because the circumstances were so informal we've shown them only in dotted-line form. The solid line is for Mr. C. Gordon Bennett's car tested last September with the 8 to one pistons. It was revved to 6000 rpm. Interestingly Walt suggested that such high revs in Jags are a waste of effort. At Riverside, he said, he shifted up at only 4500 in each gear, and picked up overdrive at 4600 in fourth. It's well below power peak, to be sure, but why grab for those last, risky revs if you don't really need them?

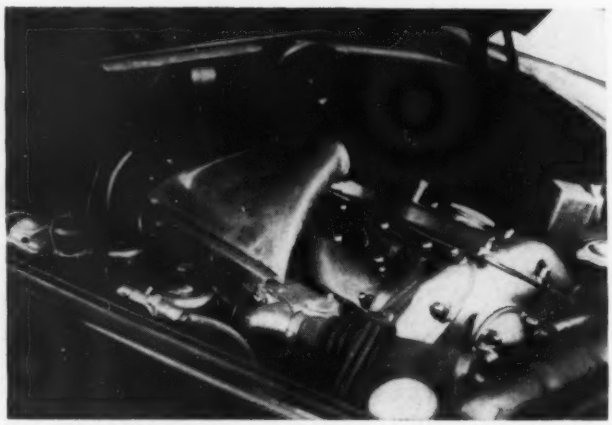
On our first run Walt shifted at 5000 and on the second at 5500. The difference is less than the usual inconsistency observed in testing such high-performance cars, so we're inclined to go along.

Originally Walt's car came equipped with D-type mufflers. Loud? Wow! With them he never needed to phone his wife to tell her he was on his way home. Much as it simplified her cooking plans, the local police were unhappy so now a very ordinary 3.8 system is used.

Just as the noise level is now normal for a Jaguar, so too is the 3.8's road behavior. The 3.8 is quite heavy for its dimensions; a beneficial result is the extreme smoothness and comfort of its ride. Again violating domestic precepts in how to go racing in a sedan, this 3.8 has standard steering, springs and shocks, the latter having been much improved in recent years. The result is smooth stability with steering whose softness lies between those American cars that are power-steered and those that are not. The wheel is placed lower than usual and more nearly horizontal too, enabling the keen driver to make the 3.8 behave like a sports car without straining either the car or himself.

In contrast with the 3.8's sports-car-like performance, its interior is, as we all know, finished off like a limousine's. One might expect that the Jaguar factory would have sent a completely stripped, gutted car to the races, but that wouldn't be sporting, would it? So the car had not only the usual back seat with its central armrest but also the full complement of highly polished wood trim pieces.

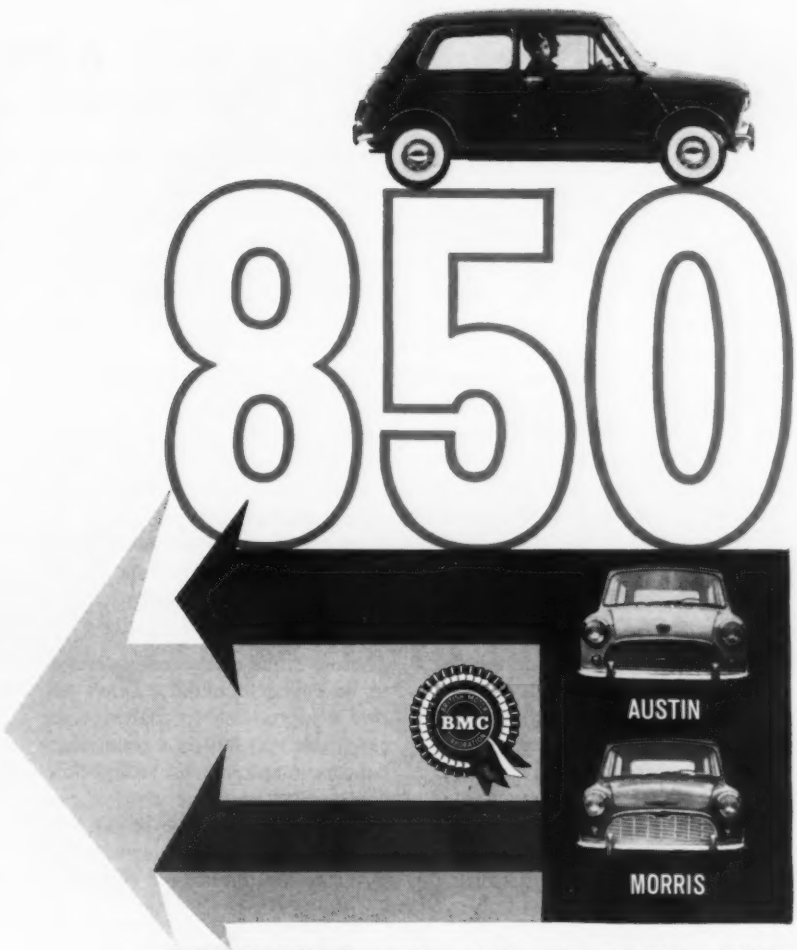
Inveterate Jaguar enthusiast Walt Hansgen grins from the bucket seat of his 3.8 sedan. Early modified XK 120s used the same kind of seating.



Only external difference between stock 3.8 Jaguar engine and factory-prepared unit is the fish-tailed air intake aimed at the two S.U.s.

Walt offered some suggestions for the best possible maintenance of these window sills and the dashboard, after pointing out that the factory now uses an improved varnish which is more suitable for the dry climate of North America. He urges each Jaguar owner to keep the wood well waxed but by all means to avoid any wax containing silicone if he ever intends to revarnish the woodwork. Be sure to read the fine print on the wax can label.

Waxing dashboards may seem a car cry from factory sedan racers. It comes up here for the reason that the 3.8 is the sort of car which the owner is proud, even anxious, to keep spotlessly clean and shining. That such a car, in full luxury trim, should be taken racing sounds like a joke. That it wins so handily proves that the 3.8 is indeed a sports sedan. —*C/D*



DESIGNED TO GO PLACES FOR MEN WHO GO PLACES BY BMC

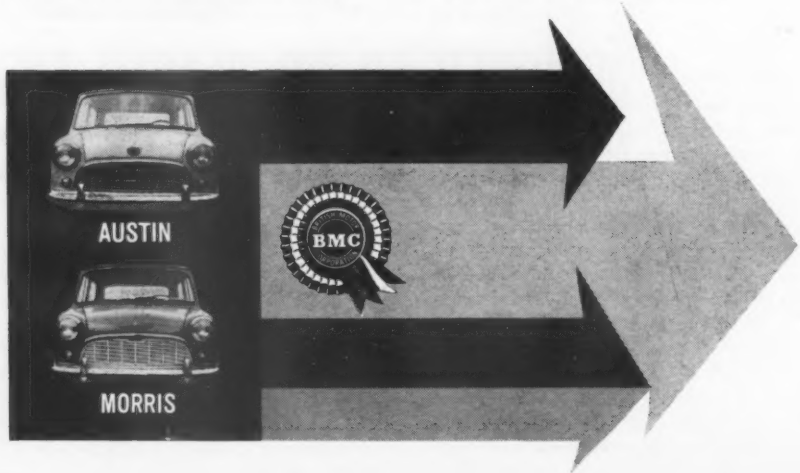
BEHIND THIS KEY THE ENGINE SITS CROSSWISE

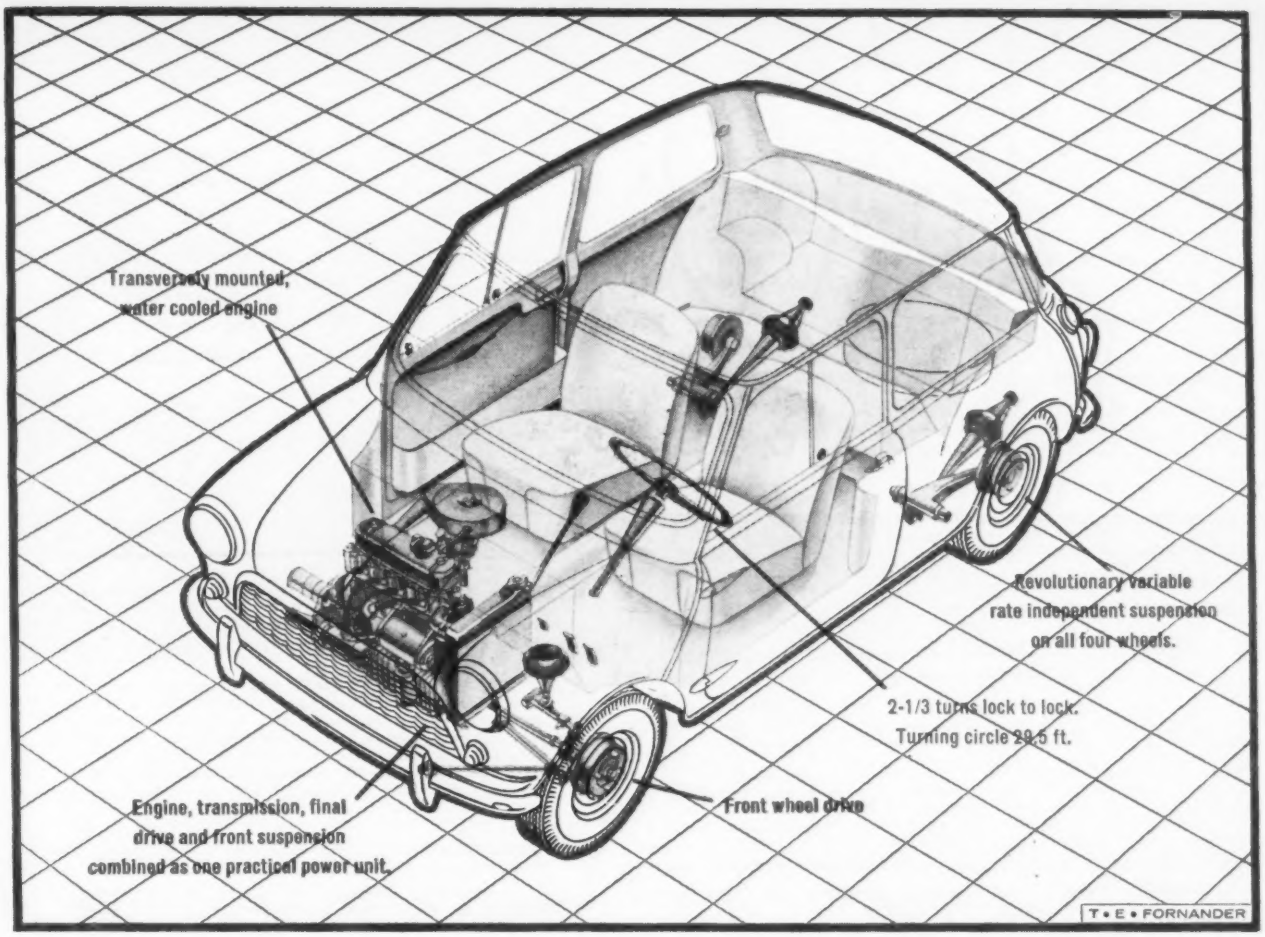
Just for shock value? No. With the engine mounted crosswise the 850 offers you a smaller car outside and a roomier one inside... more spacious than "large" economy cars, in fact. Actually, the 850 has many other exciting features, too... such as front wheel drive, revolutionary all-new suspension system coupled with scientifically controlled brakes. But it's not enough to just sit and *read* about this pint-size powerhouse. You have to *drive* it to believe it. Take an 850 out on the road today. Snap it into gear and take off. Corner it. Drive it over a rough road and compare the ride with any other car. Park it and compare again.

Now, while you're considering the verdict, we'd like to give you the benefit of a few other opinions...not to influence you, of course. For example, unpaid test-drivers have used words like "incredible," "revolutionary," "miraculous" and "fantastic" in describing the 850. These are *their* words, not ours. And, on the facing page, you'll find highly favorable opinion of the 850 from some of the most respected automotive experts in the country. Right here is a good place to say that although these people heap high praise on the 850, they can be just as expressive in their scorn for a car that is poorly conceived and poorly engineered.

Finally, one extra note on that crosswise engine. It looks small because it is mounted "East-West" rather than conventionally. But this rugged little power plant is *not* puny. Far from it. It isn't generally known, but during the 850's early tests, the engine gave such hot performance it had to be slightly *de-tuned!*

There it is. A car that really deserves to be called incredible. Don't you owe it to yourself to challenge our claim that the 850 is a totally new concept in automobiles today? Sure, you do. But heed one word of caution. When you test drive the 850, take your check book along with you. You'll be *that* impressed. Honest.




Transversely mounted, water cooled engine
Revolutionary variable rate independent suspension on all four wheels.
2-1/3 turns lock to lock. Turning circle 29.5 ft.
Front wheel drive
Engine, transmission, final drive and front suspension combined as one practical power unit.
T • E • FORNANDER

Courtesy of Car and Driver

THE AUTOMOTIVE EXPERTS GOT UNDER OUR SKIN

"The 850 is incredibly large inside, yet equally small outside. It's in some ways an adult's toy – the kind of car you feel you can park on the sidewalk. Yet for all its fun it's a very real automobile, full of purpose and ability . . . the cornering must be described as incredible.

. . . Rushing down cobblestone paving and hurtling across just-filled construction ditches on New York City's miserable streets never caught the 850 unprepared . . . between the rubber suspension and superb seats, the ride was much more comfortable than most cars of *any* size." – *Car and Driver*

"As Tiger Balm Finnegan, the Japanese yo-yo magnate, might have said, 'Big deal comes in small package!' If he had the new little Austin 850 in mind, he'd be right.

. . . For though this 80-inch wheelbase perambulator appears smallish, it has more usable interior passenger room than either the VW or Renault Dauphine and its performance is just about equal – possibly a hair equaler.

. . . The big bowl of cherries in this car becomes apparent when you put it on the road and drive it as hard as the little mill will spin. Those baby ten-inch wheels really groove the corners and the 850 whips through bends and snakes down mountain passes like water in a pipe.

. . . From any angle you slice it, at today's prices the Austin 850 is a helluva buy. . . . One thing I will guarantee: You can't find a better car for the money anywhere in the world."

– *Tom McCahill, Mechanix Illustrated*

"BMC chooses to hang such words as 'incredible' and 'revolutionary' on its new baby. Contrary to first impression, this is not American type ballyhoo; it is British understatement again. The 850 is indeed terribly hard to believe and it is a most advanced automotive design."

– *Denise McCluggage, Town and Country*

". . . the subject of today's sermon is just about as small as they come, but quite as potent as old Scottish liquor.

. . . It is possible to steer right around a rotary at speed on the accelerator.

. . . Simply cock the wheel, put your foot on the gas and the faster you go the better it corners. This you have to experience to believe." – *Cameron Dewar, Boston Herald*

"It looks like a tiny matchbox rolling on four BB bullets – one at each corner – but it zips over the road like a jackrabbit on a spree.

It's only 10 feet long and it has a 37 horsepower engine driving small wheels 5/20 by 10 but it has so much verve that one of the world's greatest racing drivers, Stirling Moss of England, lost his driver's license for a year for antics in it."

– *Bob Taylor, Newark Evening News*

850

AUSTIN 850

MORRIS 850

SPECIFICATIONS

ENGINE: Four cylinders, O.H.V. push rod operated; bore 2.48 in., stroke 2.69 in.; cubic capacity 848 c.c. (51.79 cu. in.). Three-bearing crankshaft; main bearings and connecting rod bearings with renewable liners. Compression ratio 8.3:1. Aluminum-alloy pistons. Fullflow renewable-element external oil filter.

COOLING: By pressurized thermostatically controlled system with impeller pump and fan.

IGNITION: Battery and coil. Automatic advance and retard with centrifugal and vacuum control.

CARBURETION: S. U. automatic semi-downdraught type HS2 carburetor fed from rear tank by rear-mounted S.U. electric PD type fuel pump. Air cleaner and silencer. Fuel tank capacity 6.6 U.S. gallons.

TRANSMISSION: Single-plate dry clutch with hydraulic actuation. Four-speed gearbox with synchromesh on second, third, and top gears, giving overall ratios of — first 13.657, second 8.176, third 5.317, top 3.765, and reverse 13.657:1. Central floor gear change. Combined transmission casing and oil sump below engine crankcase. Transversely mounted power unit with mainshaft in constant mesh with differential assembly mounted on side of transmission casing. Drive transmitted by universal-jointed shafts to the front road wheels. Final drive ratio 3.765:1.

BRAKES: Lockheed hydraulic brakes with limiting valve for controlled stops. Pendant-type foot pedal, 7 in. diameter brake-drums front and rear with leading and trailing shoes. Simple shoe adjustment which simultaneously adjusts the hand brake. Pull-up lever operates the hand brake on rear drums.

BODY AND CHASSIS UNIT: The unitized body incorporates the body shell, floor, bulkhead, and fenders. Full-width bumpers front and rear. Deep, well-sprung cloth upholstery. Luggage capacity 5½ cu. ft.

SUSPENSION: Independent, variable rate rubber cone suspension on all four wheels incorporating latest type ball joints and orifice type shock absorbers.

WHEELS AND TIRES: Ventilated disc-type wheels with 4-stud fixing. Dunlop 5.20 x 10 tubeless tires. Spare wheel housed in trunk.

STEERING: Rack and pinion steering with direct linkage to steering-arms on swivel pins. 15½ in. diameter 2-spoke steering-wheel with central horn button. Turning circle 29 ft. 6 in. Track—front 3 ft. 11½ in., rear 3 ft. 9⅜ in.

ELECTRICAL EQUIPMENT: High-output generator with compensated voltage control: 12-volt 34-amp.-hr. battery (at 20-hr. rate); sealed beam unit, headlights; foot dipper switch; parking lights; twin stop and tail lights; rear reflectors; rear number-plate light; instrument lighting; dual-arm windshield wipers; electric horn; flashing self cancelling direction indicators; parcel shelf light, ignition, headlight high beam, and turn signal warning lights.

INSTRUMENTS: Speedometer with total distance recorder; fuel gauge; oil pressure warning light.

CONTROLS: Windshield wiper switch; ignition switch; lighting switch; choke control; parcel shelf light switch, starter switch.

VENTILATION: Double sliding windows to each door with press-button-type lock.

GENERAL EQUIPMENT: Large curved windshield and rear window; windshield of laminated glass, all other windows of safety glass; rear view mirror; rubber floor mats with underfelt; ashtray; driver's sun visor; individual bucket front seats with adjustment for reach on driver's seat; large full width parcel tray under dash; large pockets in each door and at each side of rear seat; storage space under rear seat and behind rear seat backrest; washable headlining; cloth upholstery; sill finishers. ACCESSORY GROUP NO. 1 consisting of:—Windshield washers; foam rubber seating; wheel hub disc embellishers; hinged rear quarter lights, overriders; 2 sun visors; chrome filler cap; chrome rear number plate light.

OPTIONAL EXTRAS: Heater; Whitewall tires; Seating finished in PVC and adjustable passenger seat.

COLORS: White, Red or Blue with grey and black fleck upholstery.

Specifications and colors subject to change without notice.

Performance data: Top speed 74 m.p.h., 0-60 m.p.h. 26.5 sec., standing ¼ mile 23.3 sec. Gas consumption 40/50 m.p.g.

BMC

Products of **The British Motor Corporation, Ltd.**, makers of MG, Austin Healey, Sprite, Morris and Austin cars.
Represented in the United States by Hambro Automotive Corp., Dept. CD-5 27 West 57th Street, New York 19, N. Y.

Technical Report: MOSS MARK III

by Brock Yates and Gordon Bruce

What did Britain's sacrosanct Ministry of Speed Sports do when faced with a dearth of drivers? They created one — of course!

► The project started during the bleak years following World War II. While dozens of Englishmen labored at their drawing boards planning cars the equal of 158 Alfas and San Remo Maseratis, a tiny, confidential group was embarking on a scheme that would shake the sport to its core.

This organization was convinced the first step in making Great Britain a racing power was not the creation of a potent G.P. car, but the development of a driver superior to the contemporary greats like Farina, Ascari and Villoresi. Seaman was long since dead and Mays and Howe were retired, leaving only Reg Parnell and George Abecassis to shoulder the British burden. They reasoned if a talented young Englishman could star on a continental team, the resultant national enthusiasm would bring dozens of new green cars to the grid.

The original plan was to locate a brilliant youth and train him intensively for several years. However such a prospect was not to be found and they were forced into their fantastic alternative: the *construction of the ultimate racing driver.*

After rejecting a proposal for an out-and-out robot sloshed over with a heavy coat of B.R.G., the group decided their new device should look and act as a mortal . . . but would drive with flair, precision, and courage that no human could duplicate.

DOMINANCE BY MK I

The enterprise began with a grant of 500,000 pounds from the hush-hush Ministry of Speed Sports. A basic layout of the machine was set down by Dr. Reginald Wollstonecraft-Shelley, whose paternal grandmother, Mary Godwin-Shelley, had been a pioneer in the field.

Dr. Shelley and a team of 17 top engineers and cybernetics experts took 11 months constructing the MK I prototype. The first field test was a secret run up Prescott on April 24, 1947. Driving an ancient 1.5-liter Delage, it easily shattered the hill's record by 7.3 seconds.

The machine was named "Stirling Moss" for several reasons. "Stirling," despite the modified spelling, symbolized the integrity of the English pound and the Empire. "Moss" simply stood for "Ministry of Speed Sports."

Stirling Moss, MK I, began racing on tiny 500 cc Coopers and Kiefts. From the start he dominated the class, turning the tricky Brands Hatch course into his personal playground.

POWERPLANT ALTERATION

Between races, technical improvements continued. The power supply was altered from electrical to a highly efficient, perfectly muffled two-stroke, air-cooled engine. The original system had run directly from the car's magneto, but complications like the long cord necessary for Le Mans starts forced the change to internal combustion.

By the early 1950s Stirling was giving an excellent account of himself on such varied automobiles as the B.R.M., Jaguar, and H.W.M. And in 1954 his big chance arrived with the fabled Mercedes-Benz Grand Prix team.

Work on the MK II began in 1955 after one unpleasant fact became apparent: the MK I could be beaten. Granted, only one man was capable of the feat, but as long as Juan Fangio remained active, Moss could not reach the pinnacle of racing.

SCHULKE

Graham Hill looks on incredulously as he hears for the first time the smooth purr of pumps and gears issuing from the midriff of Moss Mk III.

The MK II was seemingly a perfect machine. Lighter by 16.5 pounds, the magnesium and plastic-compound body housed the most sensitive and intelligent computing devices known to man. After a season of development, "he" began to come into "its" own. Lap records were accumulated for nearly every major circuit in the world and after 1957 it was universally accepted that what appeared to be this pleasant young man was the finest of all racing drivers.

ONE FATAL FLAW

But the MK II had one failing: it lacked prudence. Once in the car, Moss would flog it around in a blinding series of perfectly executed drifts, slides, brakings and gear changes. Every movement would be carried out flawlessly and his car would circulate lap-on-lap at the maximum. Unfortunately this pace would continue despite drops in oil pressure, rises in water temperature, badly wearing tires or ominous crunchings from the gearbox.

Tending to run cool, the MK II required covering of the forehead cooling vents at low temperatures. Vent placement accounts for usual rearward tilt of Moss's helmet.

BATTERY PACK
POLISHED ALUMINUM HEAD
"JOHNSON" ROCKER COVER
STARTER BLUDGEON PIN
COMPUTER COOLING VENTS
PHOTOELECTRIC EYES (EXTRASENSORY PERCEPTORS)
INTERCHANGEABLE "SPA" NOSE SECTION
HORT WAVE SET
BLOWER RELIEF VALVE
RPIN VALVES
AIR INTAKE NOZZLE
NED ALUMINUM FIN" EAR DRUMS
UPPER LIP STIFFENER
FUEL INTAKE MOUTH
WAX EAR PLUGS
BUTTERFLY TONGUE FOR QUICK LAPS
DUAL-THROAT CARBURETOR NECK
FUEL TANK (MILK OF MAGNESIUM)
HEAD GASKET
TIE ROD
POCKET FILLER CAP
CHOKE COLLAR
BUILT-IN ROLL BAR
WET SLEEVE
UPPER A-ARMS
TIMING GEAR
COLLAR BONE RETAINING STUD
NURBURGRINGS
CLAVICLE SHAFT
MOSS-MINOR RACK AND PINION
STEERING ARMS
3IRDCAGE SPACE FRAME
WRIST PIN
HAND CRANK
HYDRAULIC BACK JACK
ELBOW CREASE JOINT
WIND SCREEN
FAN BELT
UPPER WISHBONES
MIXING UNIT AND BLOWER
THREE-STRING BANJO FITTING
RIBBED SECTION
STIFF-BRONZE JOINTS
BELLY PAN
ANTI-SWAY BAR
QUICK-CHANGE REAR END
COIL SPRING LOWER SUSPENSION
COOLING FAN
SAFETY RETAINING BRACKET
KICK STARTER
FIBERGLASS BODY (7-WAY STRETCH)
BIG-END BUCKET SEAT
RUMP SUMP

Having no equipment to adjust speed according to the healthiness of his conveyance, Stirling Moss MK II would continue on at full bore until he won or the ailing part shattered to pieces.

Moss's personal mechanic, Alf Francis (who everyone assumed worked on his cars) labored to inject a sense of restraint into the works. But on and on Moss went, leaving a trail of fastest laps and ruptured gearboxes across Europe. The whole thing came to a horrible climax at Spa in 1960 when a wheel parted from his Lotus at 140 mph. The driver was bent beyond repair.

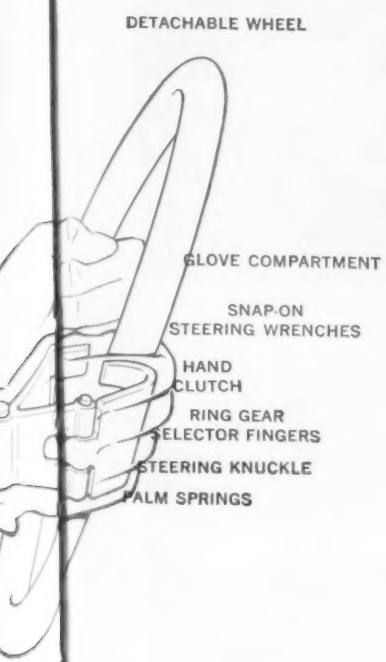
While the public was informed the great man had suffered a pair of broken legs, the organization rushed into building the MK III. Construction went ahead of schedule and the motoring world was pleasantly shocked when Moss's fractures knitted in a brief five weeks.

SPEED VARIATION EFFECTED

The MK III is the last word. Outwardly the same as its predecessor, it is equipped with a new variable-speed computer that adjusts itself to any driving situation. Moss now only drives at the peak when necessary, thereby ending his frantic, inexorable rushes for the lead. A perfect performance came at the U.S. Grand Prize at Riverside, where he dawdled along, letting the others scrap up ahead. Then full power came on at the proper moment and he slipped by his bewildered rivals to win effortlessly.

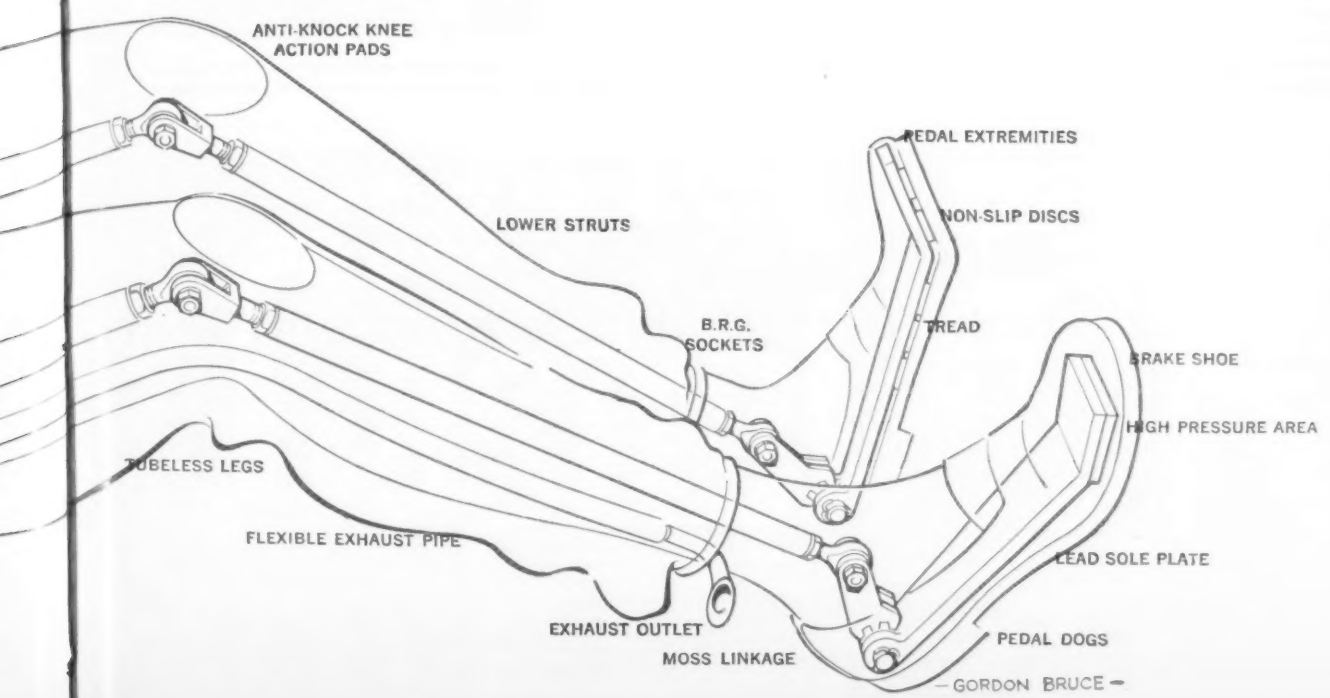
The plot was almost ruined a few years back when the R.A.C. discovered what was going on and reacted with expected huffiness. Moss had his driver's license yanked on the pretext of a traffic violation but the Club's director's were persuaded to keep silent for the good of the sport and the Commonwealth. Nonetheless the story was made public recently when a young Nassau go-karter spotted Francis replacing an oil line in Stirling's chest and blabbed to the press.

There is little reason to fear that Stirling's career will suffer now that the secret is out. Most racing authorities have accepted the revelation graciously, being more shocked that such a machine works than that such a ruse was attempted. They are in general agreement that, barring mechanical difficulties, Stirling Moss MK III will be a force to be reckoned with for many years to come. *—BY & GB*



SCHULKE

A curious group — among them Bob Holbert — looks on as a mechanic adjusts spring tension in Moss's right foot.



—GORDON BRUCE—

SUNBEAM ALPINE Series II

Rootes leads sports car scholars through a neat exercise in how to make a good car better with its latest bored-out and spruced-up two-seater.

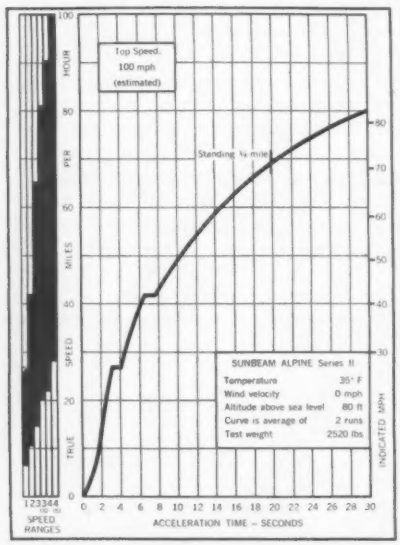
► If Alfa Giuliettas were made in England, we'd wager they'd be a lot like the new Sunbeam Alpines. The Series II, while retaining the Italo-American styling of the earlier type, features a lot more punch throughout its driving range. In addition, comfort and driver/passenger accommodations in general have been given a shot in the arm to help make the new 1.6-liter Alpine a great car for the money. Numerous technical improvements have built in added ruggedness that should make the Series II just fine for prolonged all-around use or for campaigning in Class F Production. In

ROAD TEST:

SUNBEAM ALPINE Series II

Price as tested: $3218 ($2595 basic POE East Coast, $2645 West)

Importer: Rootes Motors Inc.
42-32 21st Street
Long Island City 1, N. Y.
9830 West Pico Blvd.
Los Angeles 35, Calif.


Top Speed, 100 mph (estimated)
Standing ¼ mile
SUNBEAM ALPINE Series II
Temperature 35° F
Wind velocity 0 mph
Altitude above sea level 80 ft
Curve is average of 2 runs
Test weight 2520 lbs
TRUE MILES PER HOUR SPEED
INDICATED MPH
SPEED RANGES
ACCELERATION TIME – SECONDS

ENGINE:

Displacement ..... 97.1 cu in, 1592 cc
Dimensions ..... Four cyl, 3.21 in bore, 3.00 in stroke
Valve gear: pushrod overhead valves, nearly vertical, in line.
Compression ratio ..... 9.1 to one
Power (SAE) ..... 85½ bhp @ 5000 rpm
Torque ..... 94 lb-ft @ 3800 rpm
Usable range of engine speeds ..... 1400 to 5700 rpm
Corrected piston speed @ 5000 rpm ..... 2590 fpm
Fuel recommended ..... Premium
Mileage ..... 17-25 mpg
Range on 10.8 gallon tank ..... 185-270 miles

CHASSIS:

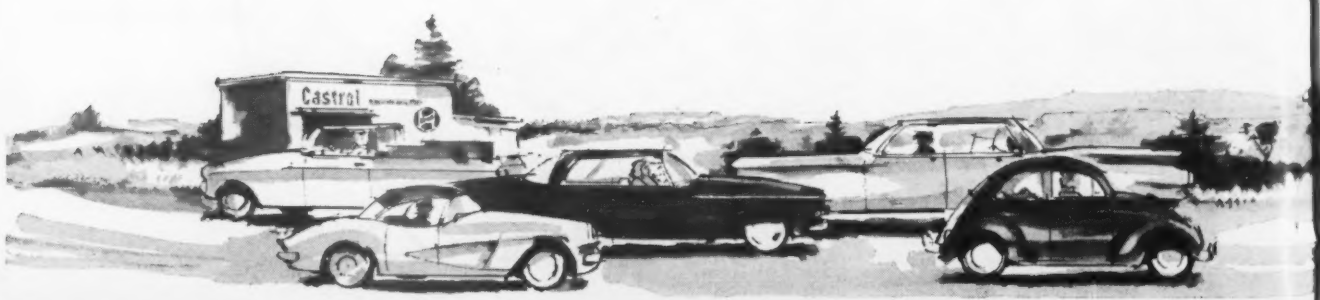
Wheelbase ..... 86.0 in
Tread ..... F 51.0, R 48.5 in
Length ..... 155.3 in
Ground clearance ..... 5.1 in
Suspension: F, ind., coil, wishbones, anti-roll bar; R, rigid axle, semi-elliptic springs.
Turns, lock to lock 3.3
Turning circles, diameter between curbs ..... 34 ft
Tire and rim size ..... 5.60 x 13
Pressures recommended: Normal F 22, R 23 psi; Fast F 25, R 27 psi.
Brakes: type, swept area: F 9½ in discs, R 9 in drum; 295 sq in
Curb weight (full tank) ..... 2300 lbs, with hardtop
Percentage on driving wheels 51.3%

DRIVE TRAIN:

Gear	Synchro?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	4.23		17.90	—3.7
1st	No	3.34	56%	14.13	4.7
2nd	Yes	2.14	54%	9.04	7.4
3rd	Yes	1.39	24%	5.88	11.4
3rd OD	Auto	1.12	12%	4.72	14.2
4th	Yes	1.00	25%	4.22	15.9
4th OD	Auto	0.80		3.39	19.7

Final Drive Ratio: 4.22 to one with overdrive, 3.89 without.

more and **more**
motorists are finding that...



case you've forgotten, Vince Tamburo nailed down that class in an Alpine last year.

Our first acquaintance with the Alpine was in our first Road Research Report in February, 1960. To clear the record, we'll now eat our words which said in part, "The Alpine is best classified as the Thunderbird . . . of the Rootes line. Compared to the related sedans it handles better, yet only its owners will consider it a genuine sports car in the fine old vintage sense of the name." The Alpine now resembles the Thunderbird only in its provision for first-rate weather protection, something the "fine old vintage" sports cars lacked. It's a relatively low-priced car, somewhat '53 Studebakerish in its styling, but it's a sports car and a good one.

The main change rests in the power unit, which has been enlarged from 1494 to 1592 cc. The power has gone from 83.5 bhp at 5300 to 85.5 bhp at 5000 rpm. The torque figure increased from 89.5 lb-ft at 3600 to an even 90, but it's sustained from 2600 up to 4600 rpm. It's this increased torque that makes the Series II Alpine come alive with solid acceleration and pulling power throughout the rpm range most frequently in use. The bore is now 3.21 inches, compared to the Series I's 3.11, but the stroke stands at 3.00 inches. The power and torque gains were not effected through a compression ratio increase. The ratio, in fact, dropped from 9.2 to 9.1 to one, but premium fuel is still required.

Other engine changes include a stiffer crankshaft, a larger water pump, a larger oil pump, a heavier-duty self-adjusting hydraulic clutch and an improved oil filter. Throughout our test, more than 700 miles of all kinds of driving, the clutch showed no signs of slip and the engine required neither oil nor water. A new exhaust system, quieter than the Alpine we remember, is featured on the Series II. It's solely a personal opinion, but we preferred the sound of the old models.

Handling and the margin of safety at high speeds have been bolstered. Larger shock absorbers and wider rear springs are two of the changes. Self-adjusting disc brakes at the front continue to be used, with drum units at the rear. There is no servo action and despite a noticeable nose dip, the brakes stop the Alpine fast and straight. The discs are now fitted with shields to keep water, dirt and grit from causing wear on the pads and disc. Chassis changes include the elimination of eight grease fittings, but no longer does the Alpine come equipped with its own grease gun. Heel-and-toeing, even with the firm brake and accelerator pressures needed, is practically automatic. Drivers of all sizes will fit in the Alpine with lots of room to spare.

We mentioned better driver and passenger accommoda-

The frameless glass windows roll flush with the door sill adding to the feeling of freedom in the generous cockpit. Leg room couldn't be better.

tions. These include pedals that are adjustable in angle and a repositioning of the overdrive lever on the left side of the steering column. The steering wheel diameter has been reduced to provide more thigh room. We'd still like to see an adjustable steering wheel on the Alpine, though.

An unsolicited testimonial from a dyed-in-the-wool MGA driver is a capsule critique of the Alpine. After driving the car for a while, he broke his silence by saying, "I hate to say it, but I like it." What is there to like? First of all, there are the outside, lockable door handles and the wind-up glass windows. There's a built-in map light over the unlidded dash compartment and a lockable, armrest/glove compartment between the foam-rubber padded bucket seats. This now hinges at the rear rather than the left side as on the Series I, making it accessible to the driver as well as the passenger. There's the rear "seat" area which can hold a child or two or a single insensitive adult. The plastic-cloth top is weather tight and can go up quickly after a little practice. One person can handle the job, but it's easier with two. A nice feature of the top is two side rails that fasten to the top of the windshield post and the main vertical top support. These effectively keep the top snug against the side windows as the top fabric is buttoned to them. The optional hardtop fits equally well. The only (*Continued on page 66*)

Under One Roof

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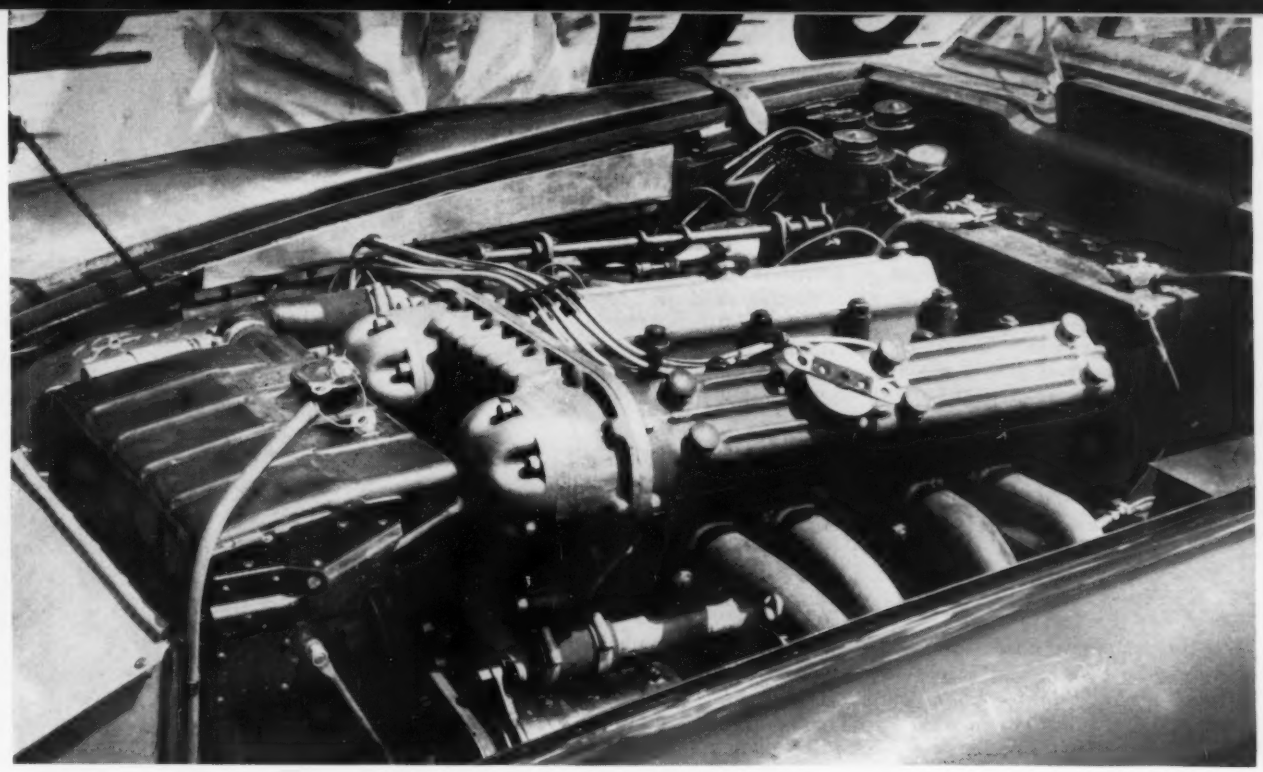


TRIUMPH'S TWIN-CAM!

by Dennis May

Racing proves a dramatic showcase for a new experimental engine, here described for the first time.

► In 1959, just a quarter-century after Triumph's first flirtation with dual overhead camshafts (remember the straight-eight Dolomite?), the prewar firm's successors quickened the pulses of the *cognoscenti* by entering a three-piece suite of d.o.h.c. cars at Le Mans. This Sarthe sortie, followed by another and more successful one last year, fermented worldwide curiosity in the breasts of TR fanciers. What, in detail, made the twin-cam engine tick? And when, if ever, would production facsimiles of it become available?

The answer to Question One unfolds hereunder, distilled from information gleaned during friendly discussions with Triumph engineers at the Coventry factory. To Question Two there still isn't an answer. Mr. Harry Webster, director and general manager of Standard-Triumph Engineering Ltd., describes the TR3-S power plant as "purely an engineering exercise in designing for easy production", and no plans at present exist for its translation into marketable merchandise. Confirming this, its external dimensions make its installation in the normal TR virtually impossible. So if you scent an apparent ambiguity in the fact that the unit has been designed and is being developed with far closer regard to labor and material costs than ultimate performance, we can only refer you back to that noun "exercise."

STRUCTURAL SANDWICH

The engine is built up in the form of a five-decker sandwich, its elements, reading from the bottom upwards, being: a) oil pan (capacity 12½ U.S. quarts); b) crankcase extension; c) crankcase; d) water jacket, housing four centrifugally cast chrome-iron liners which are in direct contact with the coolant; e) cylinder head. Uniting the head, jacket and

The TR trio at Le Mans, with restyled bodies and the twin-cam engine, hit 129 on the Mulsanne straight and finished intact in the 1960 24-hour race.

crankcase are five pairs of ½-inch studs, and five plain bearings support the crankshaft. This is a steel forging, balanced statically and dynamically, and has no vibration damper.

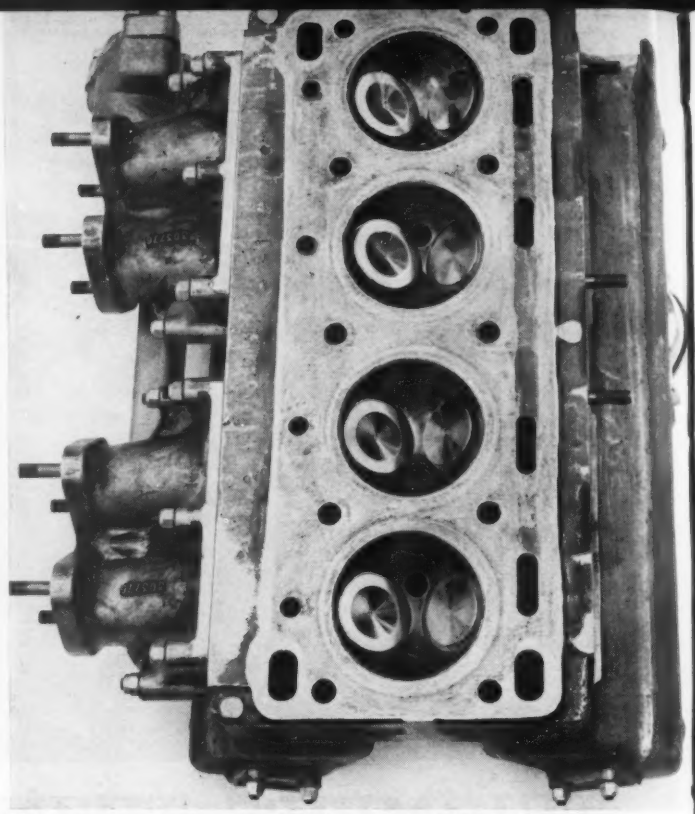
The cylinder head, water jacket, crankcase extension and pan are aluminum alloy castings, whereas the crankcase is cast iron. The 'S' engine, it's relevant to mention, has been subject to sundry variations at different stages of its life, data given here relating, unless otherwise stated, to the 1960 Le Mans version. Crankcase development is still in progress; alloy cases have been tried, some of them proving deficient in bending stiffness.

Crankshaft dimensions typify the all-around robustness of the engine, which is designed to withstand heavy duty over prolonged inter-overhaul periods. Main journal diameters are 2⅝ inches, with widths of 1⅜ inches for the front/rear pair, 1⅛ inches for the two intermediates, 1 11/16 inches at center. Forged conrods, with lower and upper bosses merged nicely into shanks with a minimum width of ¾ inch, run on crank- and wristpins with respective diameters of 2⅛ inches and 1 inch. The big ends are split at right angles to the rod axis and are 1⅛ inches wide. Mains and big ends both have steel-backed lead-indium-bronze bearings.

ALLOYS AND INSERTS

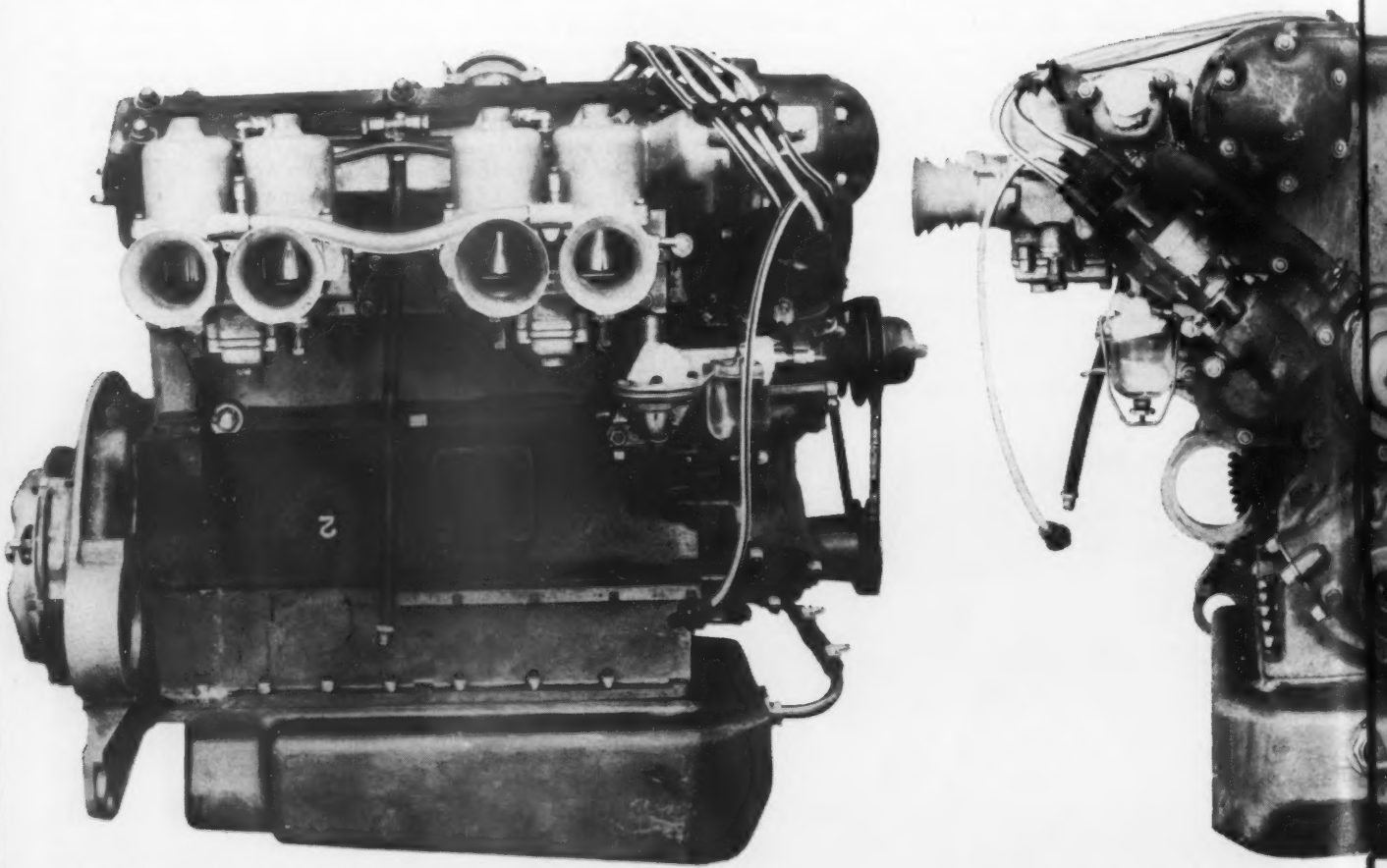
Die-cast aluminum pistons carry two compression and one oil rings, the crown form varying in accordance with the compression ratio required. The 1960 Le Mans engine (9.25 to one) had a raised but flat head; indentation for valve clearance hasn't been necessary on any TR3-S engine. Bore and stroke are 90 x 78 mm, giving a displacement of 1985 cc.

The cylinder head is cast in DTD424 alloy, very similar to general-purpose SAE 326. It has fully machined hemispherical combustion chambers disposing two valves per cyl-



Twin-cam's broad cylinder head looks typically British, with bolt-on intake piping at left. Valve seat inserts seem to be unusually thick.

Triumph's twin-cam is an alloy Dagwood sandwich: head, water jacket, block, crankcase and oil pan.



inder at an included angle of fractionally over 73 degrees. Valve slope is assymmetrical, with the exhausts inclined about 4 degrees more than the intakes. Valve material is nimonic steel, the head diameters being 1 15/16 inches for the intakes, 1⅝ inches for the exhausts. Valves carry two springs each and shut onto frozen-in seats with a Brinell hardness of approximately 360.

(Inserts to this specification were used successfully at Le Mans in '59, whereupon, on specialists' assurance that seats of half the hardness would be satisfactory, a switch was made before the 1960 event. Results confounded the experts. In the later stages of the race, all three cars suffered insert wear until their valves were finally devoid of clearance. This in turn precipitated deterioration of the valve seats themselves, seriously affecting power output. Overall, you'll remember, the Triumphs placed fifteenth, eighteenth and nineteenth out of twenty-five finishers, and were second, third and fourth in the 2-liter class. Rather interestingly, post-Le Mans tests with the clearances reset but the deckle-edged valves and pulped inserts still on duty produced outputs of 120 bhp.)

Connecting rod, with as-forged finish, has deep webbing on the big-end cap. Piston is slipper-type, having a skirt on thrust faces only.

BREATHING APPARATUS

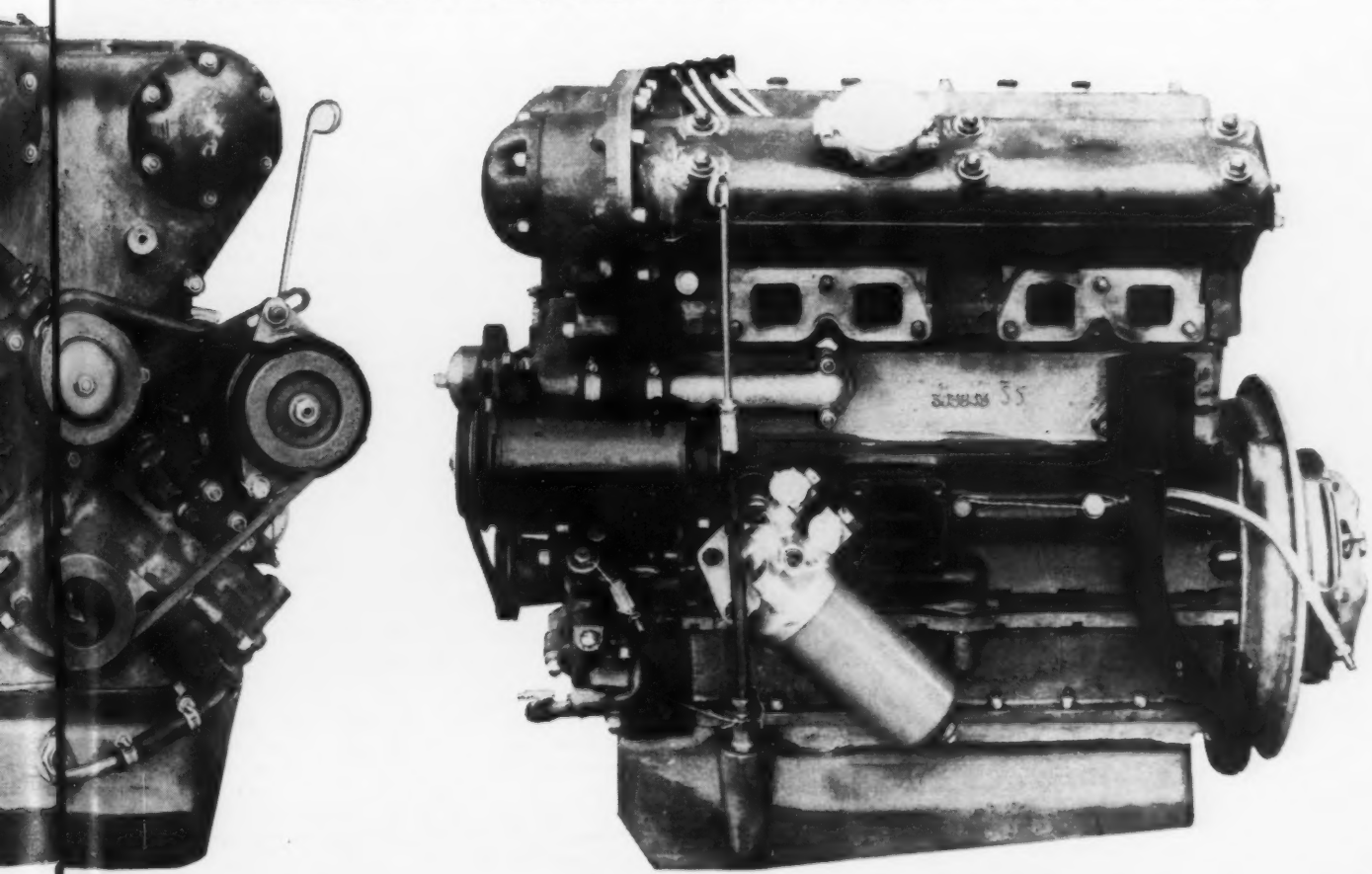
The twin camshafts are hollow, give a ⅜-inch lift and run in five 1⅛-inch diameter bearings apiece. Valve attack is via inverted bucket-type tappets working in cast iron guides and with shim adjustment. The camshafts are driven off the nose of the crank through primary and secondary duplex chains with Renold hydraulic tensioners and pad dampers. Long-reach 14 mm Lodge spark plugs screw directly into the head and are slightly offset from the longitudinal centerline, much further offset behind the lateral centerline.

All ports are separate, the diameter of the intakes being 1 11/32 inches. Exhaust ports are rectangular, 1½ x 1¼ inches, and couple up to off-takes that unite cylinders 1 and 4, 2 and 3, 16 inches from exit points; a further 18 inches down the line they merge into a single pipe and silencer. Carburetion is by two dual-throat S.U.s, type DU6, with 1¾-inch bores. These make moderate use of ram effect, total distance from the lip of the bellmouth intakes to the head face being 12 inches.

SERVICEABLE AUXILIARIES

A TR3-S feature, designed to facilitate factory assembly and subsequent servicing, is the localization of the drives to the camshafts, oil pump, fuel pump, distributor and tachometer in a single and easily-detachable case forming the engine's frontispiece. This mates with machined faces on the crankcase and water jacket *(Continued on page 64)*

It's good for racing but it's actually designed for production, likely by extensive use of die casting.



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SHAPING FOR SPEED

(Continued from page 44)

It may be accepted therefore that a vehicle of wide popularity is inevitably a compromise between numerous conflicting requirements, and most of these have been written about in one form or another fairly extensively in recent times. Such as has been written about shape, however, savours pretty much of the sort of stuff which appears in the women's glossy magazines about the creations of Hartnell, Balmain, Dior, *et al*, and this, goodness knows, provides little enough meat for those who take their motoring seriously. Let us, therefore, cast an objective eye on this question of shape.

There is a very direct relationship between the amount of power, and therefore the amount of fuel, required to propel any given vehicle through the air and over the ground at a set speed. Take a look at Fig. 2, which represents, nearly enough, the curve of the power required by the MG TC, the first European car to make any real impact in the American market. It will be seen that 60 bhp would be consumed in pushing this vehicle forward over the level road at 83 mph. Further, considering the dotted extension of the curve, it will be realized that beyond the maximum speed then available, an addition of 16 percent in bhp would have increased the maximum speed by rather less than 4 percent. With the TC and its direct derivatives, the TD and TF, the law of diminishing returns had come into operation with a vengeance. Something had to be done about it. But what?

For an elegant answer to this question it was first desirable to know something of the ultimate at which to aim. At first glance it may be thought that, with all the time and money spent by the nations of the world in the development of aircraft and projectiles, everything possible was already known about aerodynamics, certainly at the sort of speeds which the sports car designer is considering. But a moment's further reflection will recall the one essential difference, that aircraft and projectiles move freely in three dimensions, whereas the sports car moves, with luck, only in two, and the presence of the road has to be taken into account, including what goes on between the underside of the vehicle and the surface on which it runs.

Here we begin to see the first glimmer of one of the reasons why the MG Car Company, off and on over the past 30 years, has engaged in the "pastime" of record-breaking.

Thanks to the work of the aircraft industry, the amount of power required to propel a given shape through the air is known fairly exactly. Additional drag forces—usually lumped together under the head of "rolling resistance", comprising friction losses in the cycle parts of the vehicle, power losses in the tires, and turbulence between car and road—are much less exactly known, nor is it yet established that comparable conditions can be recreated in the wind tunnel with a simulated road consisting of a belt moving at the same speed as the wind. For long enough the MG engineers have recognized that the only way to be sure is to go and find out.

In every record-breaking attempt undertaken since 1937 and up to the present day—with the exception of those few where unforeseeable factors have intervened—MG engineers have known the precise power being generated at the speed obtained and the drag of the vehicle in free air. From this they have been able to calculate the incalculable, and have amassed a wealth of data which enables rolling resistance to be deduced with considerable accuracy in any given set of circumstances.

Fig. 1 shows in the dotted curve the total drag of the experimental car, EX 135, driven by Major A. T. "Goldie" Gardner under a wide variety of differing conditions between 1937 and 1952. The solid curve is that of the MG EX 181, with which Phil Hill exceeded 250 mph in October, 1959.

These designs represented what, at the time of their inception, was regarded as the ideal for maximum penetration, and had the merit of providing a known goal toward which the engineers would strive in the design of a passenger-carrying sports car. But, of course, before such a design could emerge, all manner of requirements, extraneous to the pure business of record-breaking, would have to be taken into account. Passenger cars for general acceptance must have doors which offer reasonably simple entrance and exit. Road wheels must be capable of being changed without too large a surgical operation. Cars for use on the road need headlamps, tail-lamps, and turn indicators, in positions prescribed by law. The car must have all-weather protection, be capable of carrying baggage and, not least, a passenger. Having said all this, and allowed for all these things, it is not an unrewarding exercise to view the MGA and mentally denude it of these essential excrescences. It is surprising how the basic shape of EX 181 begins to emerge.

The cost of the excrescences in terms of performance is, of course, high, and the dash line in Fig. 2 represents the total drag of the MGA in its complete state. Though this is a far cry from the idealized EX 181, it is a vast improvement on the TC. If one considers for the moment an available 60 bhp in both cases, it will be seen that shape alone has yielded 12 mph.

Where next? In the course of the researches into EX181 all manner of strange shapes were tried. Not least of these was EX 181/7, but the best potential advantages of this could be realized only when the lower edge of the vehicle was brought very close to the ground, a feature which, in the absence of some form of rubber or flexible skirt, made this form impractical for normal use. At the other extreme lay a vehicle pitched high in the air, so that it could be considered more nearly as a true projectile free of the influences of the ground, except where the essential wheels protruded through its underside. It is perhaps too early to say in which direction design will go, but where maximum penetration is a strong consideration the move will certainly be one way or the other. *—JT*

Some people think the ash tray is too small

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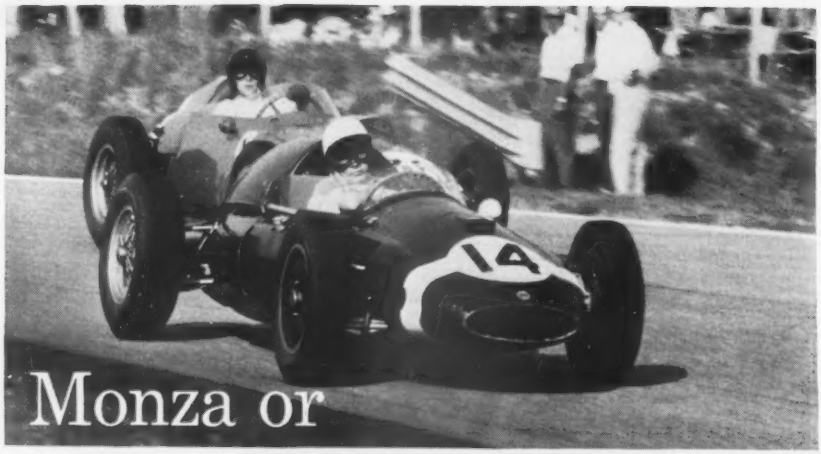

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TRIUMPH'S TWIN-CAM

(Continued from page 61)

and has a magnesium alloy cover plate, secured by twenty-three 5/16-inch setscrews. Against possible future contingencies, there is provision for driving a fuel injection pump and an oil scavenge pump, and the space occupied by the distributor would allow for the substitution of a magneto. The complete cylinder head assembly is removable without disturbing the valve timing.

The oil pump is skew driven from the crank nose and its pressure relief valve is integral with it. A mechanical fuel pump is eccentrically driven by skew gears from the oil pump spindle. A single belt drives the water pump and the generator.

Every bearing in the engine is plain, and pressure-lubricated. On the suction side of the system, oil is picked up through a large-diameter filter placed close to the pan floor, the coolest region. On the pressure side it traverses a full-flow filter and enters a gallery running the full length of the crankcase; thence it reaches the mains through crankcase drillways, supply to the big ends being via the corresponding mains. The crank is cross-drilled to form sludge traps. A further crankcase drilling connects with the timing case, where individual passages take it to the cam boxes, fuel pump drive and chain tensioners. The camshaft bearings receive oil through the hollow shafts themselves, the cams dipping into baths whose level is regulated by the placement of an orifice connecting with a gravity return route to the crankcase at the front of the head and block.

POWER FOR LE MANS

Performance figures for last year's Le Mans engine were as follows: "150-plus" bhp at 6500 rpm. Maximum torque, 142 pound-feet at 5000 rpm. Corrected piston speed at 6500 rpm, power-peak point, works out to 3670 fpm. At Le Mans, says Ken Richardson, Standard-Triumph competition manager, the highest speed reached on the Mulsanne Straight was 129 mph. Before the valve-insert trouble, the best-placed TR3-S was lapping at 103.8 mph.

From timing cover to flywheel face, the engine measures 26¼ inches, which is 3¼ inches more than the normal TR3 powerplant. Overall width is the same as the pushrodder's — 18 inches — and height more than an inch less at 26¼ inches. Although sections throughout the 'S' unit are very generous (appropriate to "an exercise in production engineering") and exotic materials are everywhere eschewed, its weight, 438 pounds including clutch, starter motor, generator and fuel pump, undercuts the TR3's by 14 pounds.

Standard-Triumph's attitude to Le Mans is inconsequential. The Sarthe circuit was never envisioned as a proving ground when the two-cam engine was first designed and built. "It just happened to produce an encouraging output," says Mr. Webster, "and as we had a chassis ready to hand that could be adapted to receive it without too much trouble, it seemed an obvious thing to do." But don't wear out hacksaw blades cutting your TR frame in half to let lengtheners in yet because the die has not been cast for the production of this die-cast engine. —*DM*

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(Continued from page 57)

reservation we had about the top was the somewhat haphazard way in which the flexible plastic rear window is stored. It would require careful attention in folding to keep it from being damaged.

A twist of the key brings the Alpine to life. Ours idled nicely at about 1000 rpm (650 to 700 is specified) and warmed up quickly, although on our car the temperature needle never rose over 170 degrees. A firm push is needed to open the throttle of the two down-draft Solexes. The clutch bites low, clean and solid and, depending on the amount of throttle starts can be sedate or savage. Blasting off from a stop may provoke rear axle hop if too much power is used. The shift has a firm, almost stiff, feel and a positive pattern, but the shift knob has a sharp edge which we found annoying; if it bothers you too, buy a round chrome knob from one of our advertisers. For general driving, you can use first, second, third and third o.d. Fourth is virtually identical to the latter gear and clutch-free shifting is instantaneous with the handy o.d. lever. Fourth overdrive makes cruising at an indicated 70 free and easy. It's quite easy to ignore entirely the presence of fourth direct. Simply shift from third, to third o.d. and to fourth o.d.

The Alpine takes even violent bumps without excessive kickback at the steering wheel although they can make the rear end dance a bit. Entering a smooth fast sweeper, downshifts go crisply and as the wheels are turned into the curve the car cants slightly then holds that angle all the way through. The steering is light toward the center of the lock, becoming heavier as the angle increases. Self-centering forces are present but not excessive and the rear end behaves itself in a predictable, controllable way. It can be broken loose, but most drivers will never experience it. Essentially the Alpine is an understeering car; it will perform for enthusiasts, but should offer no handling surprises to newcomers. A marked improvement over the Series I, it's an easy car to drive and its price and reliability should make it easy to own and maintain. —*C/D*

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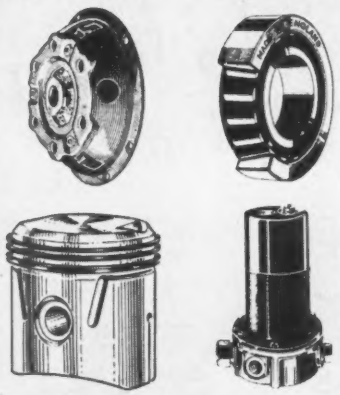

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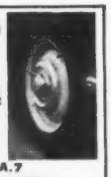

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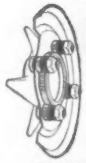

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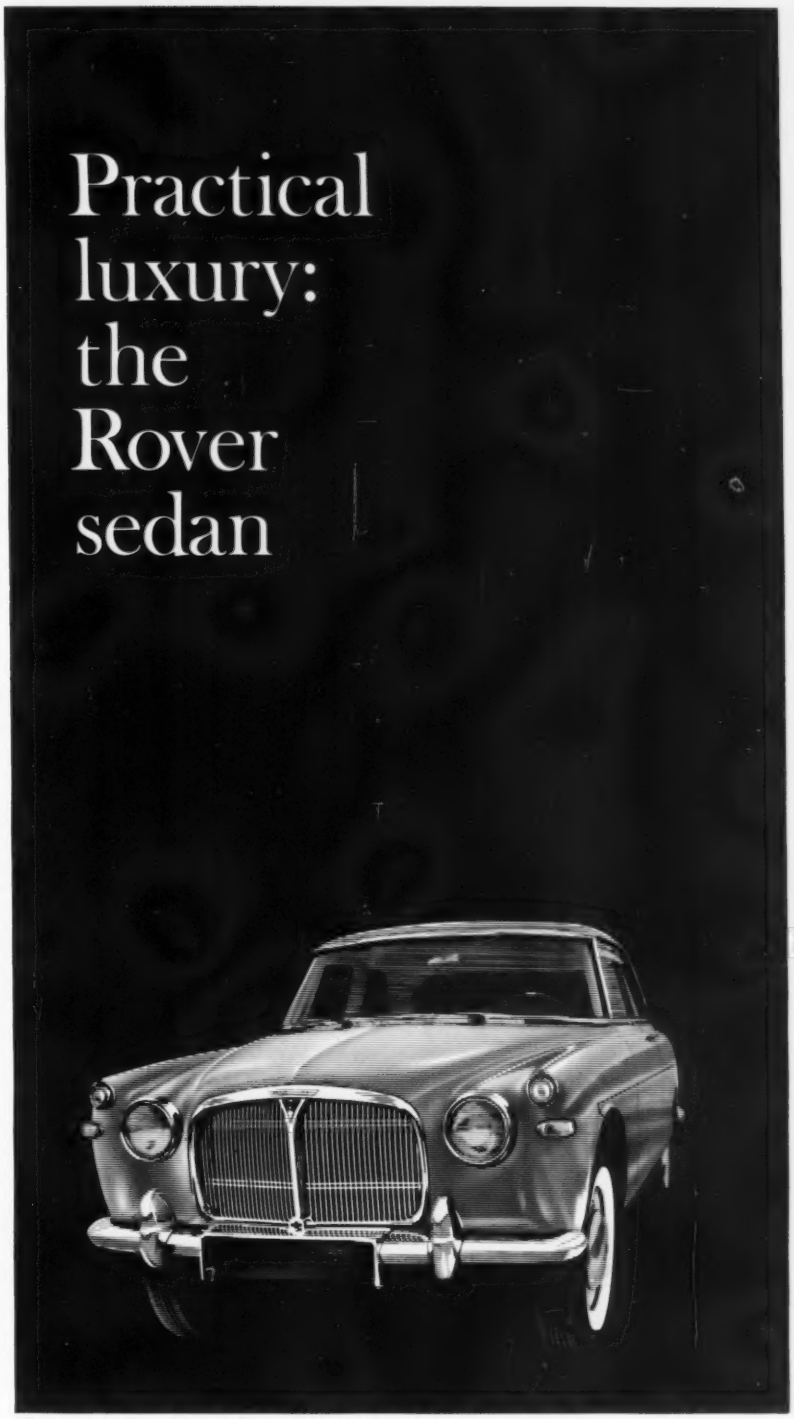

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Absolutely right.

Which is just what happened recently when two of our neighbors in the automobile business came out with Volkswagen-type station wagons.

In fact, that's exactly how most of the newspaper stories described the vehicles when they were unveiled: "Volkswagen-type" station wagons.

We thought it was quite a compliment. Not just for our wagon. But for every family that had the audacity to buy one during the last 11 years.

It means that the Volkswagen Station Wagon is no longer an innovation.

It is now officially a trend.

The VW Station Wagon is a new type of automotive animal—the equivalent of a steer that's all steak, or a turkey that has 4 drumsticks.

(Although, like a 4-legged turkey, it looks a little strange at first.)

It's 4 feet shorter than a regular wagon, yet it holds more: 9 passengers, plus 28 cubic feet of luggage. (No either/or.)

It's only 9 inches longer than a VW Sedan, although you probably won't believe it until you see the two side by side. (People have won bets on this one.)

Take off a couple of wing nuts, pull out the center seat, and you've got enough space for an open playpen (with baby), or even an open bridge table (with players). A thriving car pool out in San Francisco discovered that one.

Take out both rear seats, and you can open up a pair of cots and sleep inside under the stars!

It has an air-cooled engine.

No water to boil.

No water to freeze.

Its engine is in the rear, which explains the outstanding traction. In mud, sand, ice or snow, when others skid, you go.

(Incidentally, that's one reason why the VW Wagon is a favorite with skiers.)

Now you can understand why this station wagon is being followed.

But bear this in mind: A "Volkswagen-type" station wagon is not a Volkswagen.

Not quite.

The Volkswagen Station Wagon has been in production for 11 years.

Improvements have been made every year, but the basic design has remained the same.

Continuity has led to quality.

The doors fit properly.

The rattles were silenced years ago.

All we ask of our men is that they make each Volkswagen as if they were going to own it themselves.

The finish is a labor of love: 4 coats of paint (44 lbs. of it), including a dip in paint over its head and two complete hand-sandings.

And only the VW Station Wagon has the guts of a VW: the engine that can run all day long at top speed without straining a cylinder, and deliver the legendary Volkswagen mileage.

Parts availability and service? Every bit as good as the Volkswagen Sedan.

But here's the clincher:

A *Deluxe* VW Station Wagon costs about the same or less than the *standard* model of a "VW-type" wagon. And the VW comes with sun roof and skylight windows!

The Deluxe VW Station Wagon is $2,620. Our Standard VW Wagon (without sun roof) is $2,245.

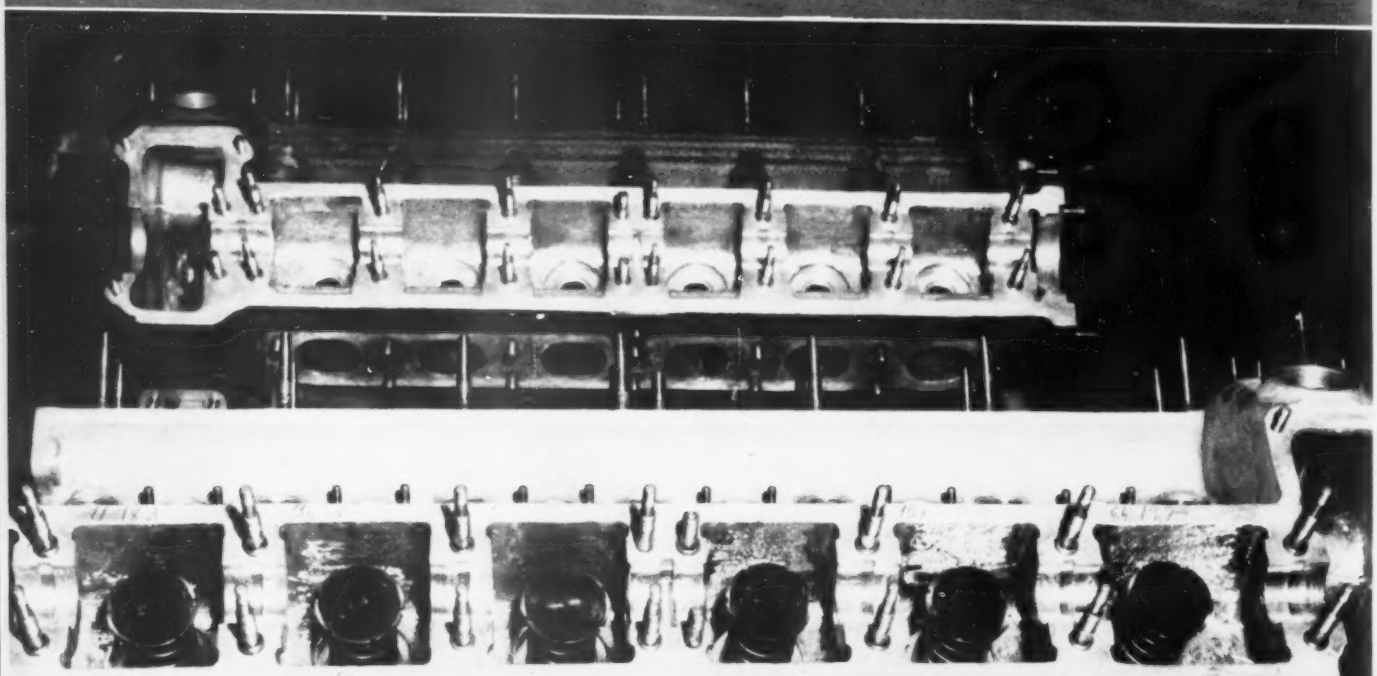
These are the suggested retail prices at the East Coast ports of entry.

And both VWs come equipped with heater/defroster, bumper overriders, 4-speed fully synchronized transmission, the third seat in the rear, and the fully finished interior.

All of these are optional extras on the "VW-type" wagons.

When the Volkswagen Station Wagon was introduced back in 1950, it was eleven years ahead of its time.

Its time has now come.



Road Research Report: MASERATI 3500 G.T.

► The Maserati 3500 G.T. costs a lot of money. Of the cars in this five-figure price range, one claims simply to be The Best Car in the World and another to be The Standard of the World. In that particular field those two have little competition except each other and seem easy to judge since the requirements are so simple: the luxury sedan must be extraordinarily quiet and comfortable, reasonably fast and nearly perfect in detail finish. Racing cars (which cost as much and sometimes more) have equally rigorous standards; the question of which one is best is fought out on the race tracks with rarely a clear-cut decision.

With the 3500 G.T., the Maserati firm is in that nearly impossible position of building a car that is something of both, yet neither. Imagine, if you will, a "perfect" racing car widened to carry two and clothed in near-limousine elegance and luxury – and to sell at the same price as either.

Other firms, to make matters trying for them and delightful for buyers and onlookers alike, provide as much competition here as the pure-blooded sister cars get on the track. There's Aston, Mercedes and, built nearby, Ferrari, each with considerable history of experience in this contentious field. After all, when a car costs *this* much, it must come mighty close to being the very best car in its field regardless of price.

And yet, in this field of grand touring car (of the not-for-serious racing variety), one man's best is another's poison in the strongest manner. That's equally true in building cars that are meant for racing, but making minor adjustments to the scuderia's number one car is far, far simpler than shifting the contours of the leather-covered foam-rubber-filled reclining seats. Build to order? Even the customer can't afford to stand still while the workmen measure and hammer and saw and modify.

Yes, the $10,000-and-up sports car market is a persnickety one. The buyers demand perfection – and can't afford it.

ENGINE DESIGN HISTORY

Ever since they took over ownership and operation of the Maserati plant in 1937, Adolfo Orsi and his son Omer were anxious to build a touring car. No doubt they had ideas about making the business pay. After the war they tried several designs but none was impressive. In 1953 Ing. Colombo, working in consultation with Maserati engineer Bellentani, came up with a very fine two-liter sports-racing car, the A6GCS, which provided the inspiration for a six-cylinder touring car design. The first examples of this A6G/2000 were built in 1954, and shown at Geneva and Paris.

This new touring engine kept the 76.5 x 72 mm dimensions, the seven main bearings and the overhead valve inclinations (36° intake, 41° exhaust) of its sports predecessor. Instead of gears to drive the twin overhead cams, though, it had a simple chain system driven by a half-speed gear from the nose of the crankshaft. Instead of the traditional Maserati finger cam followers, it used the Alfa Romeo method: a mushroom tappet screwed directly onto the valve stem and kept from rotating by valve spring pressure. This system was probably brought over to Maserati by Colombo, who worked with the original proponent of the idea – Jano – at Alfa.

At first the A6G/2000 had single ignition and a single twin-throat carb, but this didn't give brilliant performance. The sports car's dual ignition and triple twin-throat Webers were restored and the finalized A6G/2000A was introduced at Geneva in March of 1955. This proved to be an enjoyable car but not widely salable or as good an all-rounder as the 3-liter Europa Ferrari that was making a big impression at that time. The success they'd had in racing the 250F Grand Prix car and designing the 300S sports car inspired the Orsis to put Bellentani to work on a new 3½-liter touring engine that could also be used in racing, and – in parallel – on a 4½-liter full-racing V8. If the 3½-liter could do the job (outracing Ferrari and outselling him too) they'd be all set, but they wanted the V8 as a backstop.

CREATING THE 3.5

From the start the 3½-liter, or 350S as it was then known, had a remarkably long stroke with dimensions of 86 x 100 mm. It's likely they wanted to keep the engine as short as possible. Bellentani may also have been put off by the poor results he got with some very

Cylinder head in background is that of A6G/2000A 2-liter Maserati, from which the 3500 G.T. engine is descended. Head in foreground is that of the interim 350S sports-racing engine, which used seven cam bearings and the screw-on tappets later replaced by Jaguar-type inverted buckets.

oversquare engines he tried while working toward the 300S.

In every respect the 350S engine was derived much more from the two-liter touring engine than from the racing 250F and 300S sixes. Again it had seven main bearings, 3 inches in diameter. Con rod journals measured 2¼ inches. It had the same two-stage gear/chain drive to the cams, and the same Alfa-type screwed-tappet valve gear. This gave it a remarkable kinship to the Alfa Romeo *Disco Volante* engine of 1953, which had the same displacement (88 x 98 mm), the same drive and the same valve gear. Valves on the 350S were symmetrically inclined at 37° to the vertical.

Simplifications were effected. Passages for cold water entry and oil drainage were cast in place instead of made separate, as on the two-liter. From the back of the cast-in cold water gallery a pipe was fitted to carry coolant direct to the head, to ports just above the exhaust valve guides and seats, as on the 250F and 300S. First distributors, later magnetos were driven off the back ends of the camshaft, just as on the two-liter.

Originally there were racing features too. The water pump and generator were gear driven. The clutch was racing-type multiple disc. A dry sump lubrication system was used, with the scavenge and pressure pumps mounted externally in front of the crankcase and joined to the engine's veins and arteries by much exposed pipework. Breathing through 45 mm Weber carbs, this engine was developed to give 276 bhp at 5700 rpm, as of July 10, 1956. Its peak torque was 263 pound-feet at 4500, with an amazingly flat curve that held 260 pound-feet between 3800 and 5200 rpm. That peak torque corresponds to a peak bmep of 187 psi. The look-alike *Disco Volante* Alfa engine developed a similar 270 bhp at a higher 6500 rpm, on an 8.2-to-one compression ratio instead of the Maser's 9 to one.

BAPTISM IN COMPETITION

The 350S engine first competed at Dakar in March of 1956, when Behra turned some very fast practice laps but used a 300S in the race. Then it was probably fitted in a 300S chassis, but by April and the Mille Miglia a completely new chassis had been built, actually to suit the still-gestating 4½-liter V8. Two cars were planned but Taruffi turned his down and Moss's was completed just in time for the Mille Miglia, in which it understeered right off the road.

The second 350S was later completed and sold to Piotti. It was apparently fitted with a 300S gearbox instead of the massive 450S unit, though its chassis dimensions were those of the 450S. This car raced but retired at Bari in July, appeared for practice only in Sweden in August, 1956, then managed to place fifth in the Buenos Aires sports car race in January, 1957 with Piotti and Bonomi driving. Thereafter it raced no more, but may have served as a test bed for components for the touring edition.

During 1956 parallel development went ahead on a milder version of the 350S, now under the direction of Ing. Alfieri. At first this consisted of fitting a roomy wet sump, leaving off the scavenging oil pump and attaching a large air cleaner. Later it involved a top-to-bottom redesign before the 3500 G.T. prototype was first shown at Geneva on March 20, 1957. In his rework Alfieri stressed "engineering expressly for street use in the United States. Emphasis was placed on developing substantial torque at low rpm and on a light clutch and smooth-functioning gearbox." Clearly Maserati knew where such cars could be sold.

VALVE GEAR REWORKED

Toward the end of its racing development, the 350S had been fitted with special external oil galleries to spray lubricant across the cams and tappets, indicating that the original screw-type tappet wasn't satisfactory from a wear standpoint. Perhaps this was why Alfieri replaced it with the heavier Jaguar-style piston-type tappet the 3500 G.T. now uses. While the 350S needed seven camshaft support bearings, the new 3500 G.T. arrangement called for only four.

The direct water feed to the cylinder head vanished, though the ports above the valves remained. The two separate distributors were removed from the backs of the cams and combined in a single dual-coil unit driven by skew gearing from the front of the crankshaft. Conventional belt drive to the water pump and generator was adopted, but the racing-style external oil pump remained. The main oil gallery was newly integral-cast, and the size of the wet sump was reduced by about one third from the prototypes. A more ordinary clutch was substituted for the racing-type assembly, and given hydraulic actuation.

At the Geneva announcement the 3500 G.T. power was given as 226 bhp at 5500 rpm, but they were still working on the cam contours to get that low-end torque. By Turin Show time late in 1957 this was done, with 40°-60° intake timing and 65°-30° exhaust timing. Announced power was now 230.

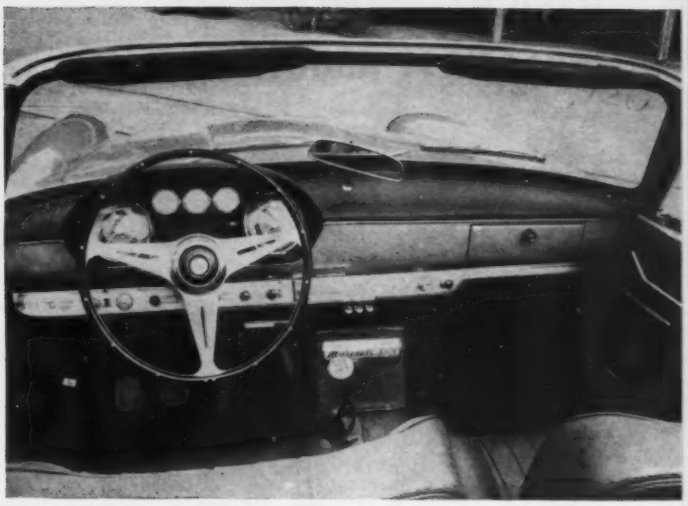
With the engine in this trim and tune, the body was standardized and production begun. These Masers became almost common in Italy by late 1958, and SCI tested the first one in the States in the November, 1958 issue. Through 1959 Alfieri learned about his design, learned about the art of building a good touring engine — something Maserati had never done before. During the '59-'60 winter he carried out another thorough revision, targeted on lower cost, greater smoothness and enhanced reliability. Power was no problem.

FURTHER TAMED FOR TOURING

A new cylinder head casting was drawn up, eliminating the vestigial water inlet ports and doing away with the traditional Maserati fairing around the intake valve guide. The latest Weber 42 DCOE6 carburetors replaced the earlier 42 DCE units, both having a 42 mm bore. An 8.5 to one compression ratio was standardized and the pistons were given a thicker crown and lower skirts that are cut away to clear the crank counterweights.

As the cross-section drawing shows, the cylinder liners are dry over most (*Continued on page 86; data overleaf*)

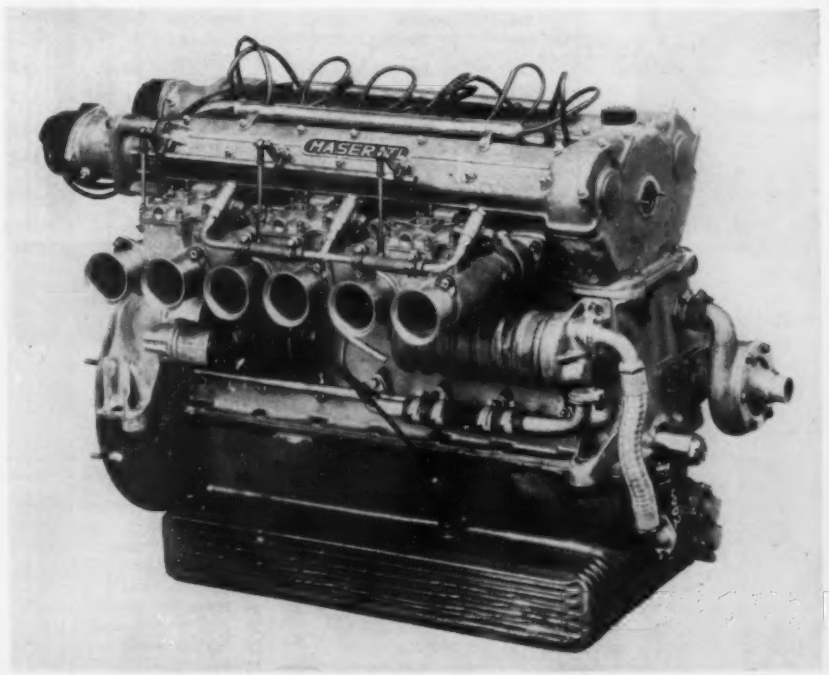
Access to rear seats is enhanced by a front seat that slides forward as its back hinges forward. The centrally-placed ashtray is convenient.



Vignale's dash layout for the roadster differs greatly from Touring's coupe panel, though it uses the same British-made Jaeger instruments.

Racy Maserati roadster is built on shorter chassis by Vignale. Like the coupe, it can have wire wheels fitted instead of discs, and a trim detachable hardtop is also in the 3500 G.T. catalogue.

Knob on ZF box has typical German look. The ashtray lid carries a tiny Maserati emblem.



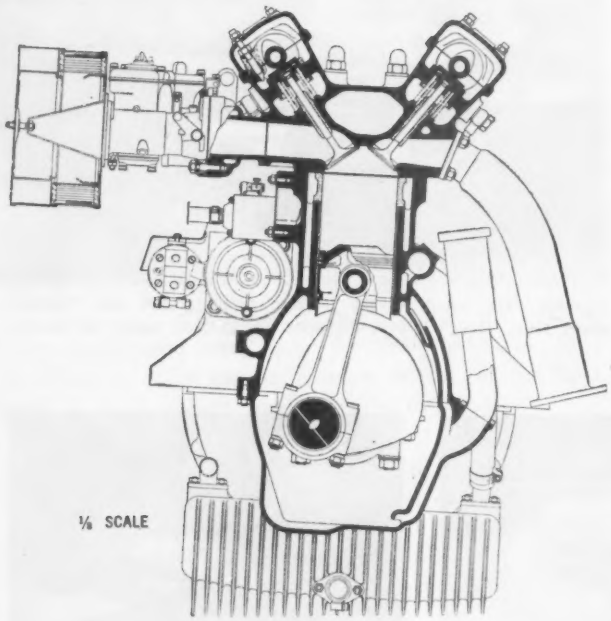
Original 350S engine differed vastly from production 3500 G.T. unit. This shows wet-sump version, which still has racing-type external oil lines and gallery, and dual distributors on backs of cams.

You don't have to use the key to open the gas cap lid, but it does beat broken fingernails.

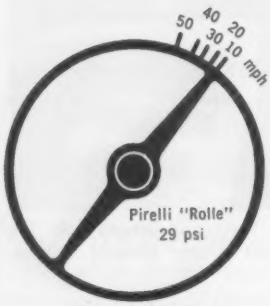
Road Research Report:
MASERATI 3500 G.T.

Importers: Rallye Motors Inc., 46 Sea Cliff Ave., Glen Cove, L. I., N. Y. — Maserati Representatives of Calif., 11941 Wilshire Blvd., Los Angeles 25, California

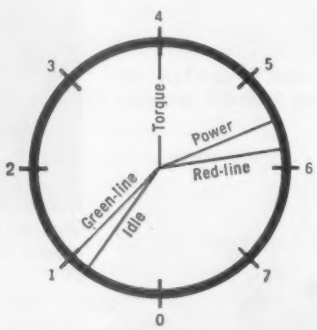
Number of U. S. dealers: 4
Planned annual production: 600-750
Dollar value of spare parts in U.S.: $25,000



⅛ SCALE



Steering Behavior
Wheel position to maintain 400-foot circle at speeds indicated.



Engine Flexibility
RPM in thousands

PRICES:

Basic Price	$11,400
Wire wheels	510
Price as tested	11,910
Other model:	
Convertible	12,300

OPERATING SCHEDULE:

Fuel recommended	Premium
Mileage	11-20 mpg
Range on 21-gallon tank	230-420 miles
Oils recommended	Summer: SAE 50, Winter: SAE 40
Crankcase capacity	9½ quarts
Change at intervals of	2400 miles
Number of grease fittings	17
Lubrication interval	2400 miles

Most frequent maintenance, interval recommended: Change oil filter cartridge, clean and reset points and plugs—2400 miles

ENGINE: (Tilted 4°, aluminum alloy crankcase and head)

Displacement	213 cu in, 3485 cc
Dimensions	Six cyl, 3.39 in bore, 3.94 in stroke
Valve gear:	Chain-driven double overhead camshafts, inclined valves at 75° included angle
Compression ratio	8.5 to one
Power (SAE)	260 bhp @ 5500 rpm
Torque	260 lb-ft @ 4000 rpm
Usable range of engine speeds	1000-5800 rpm
Corrected piston speed @ 5500 rpm	3530 fpm

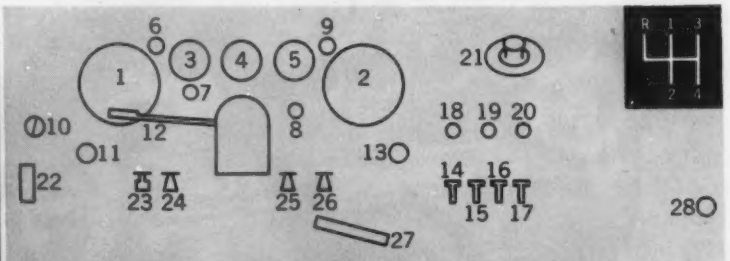
CHASSIS:

Wheelbase	102.3 in (Convertible: 98.4 in)
Tread	F 54.7, R 53.6 in
Length	188.1 in (Convertible: 175.5 in)
Ground clearance	5.9 in
Suspension:	F, ind., coil, wishbones, anti roll bar; R, rigid axle, leaf springs, 2 upper outboard trailing arms, one R.H. lower one, anti-roll bar
Turns, lock to lock	4.2
Turning circle diameter between curbs	40 ft
Tire and rim size	6.50 x 16, 16 x 5.00
Pressures recommended	24 psi touring, 27 psi high speeds
Brakes; type, swept area	F 12 in disc, R 12 in drum; 524 sq in
Curb weight (full tank)	3160 lbs
Percentage on driving wheels	51%

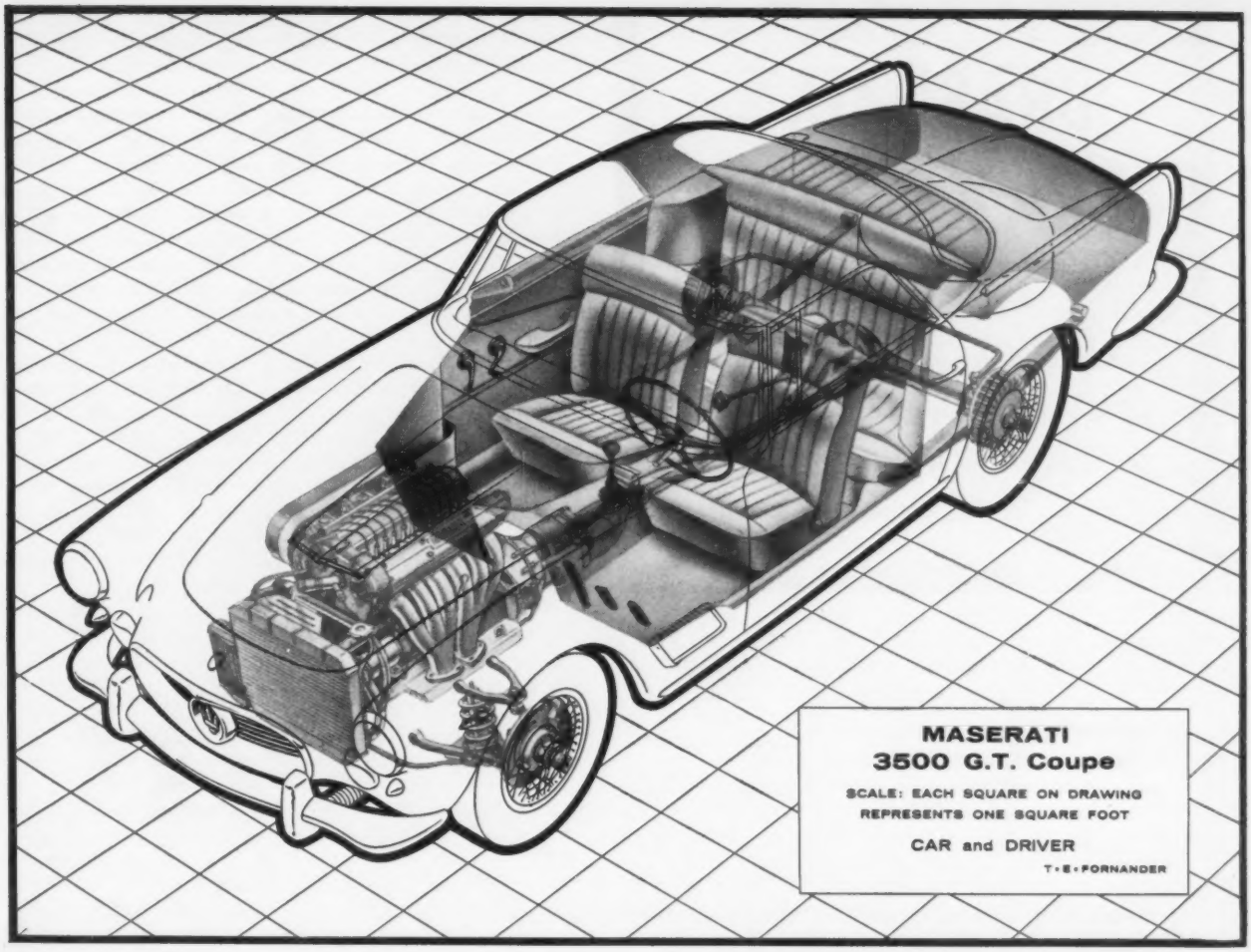
DRIVE TRAIN: (Z-F gearbox, Salisbury axle)

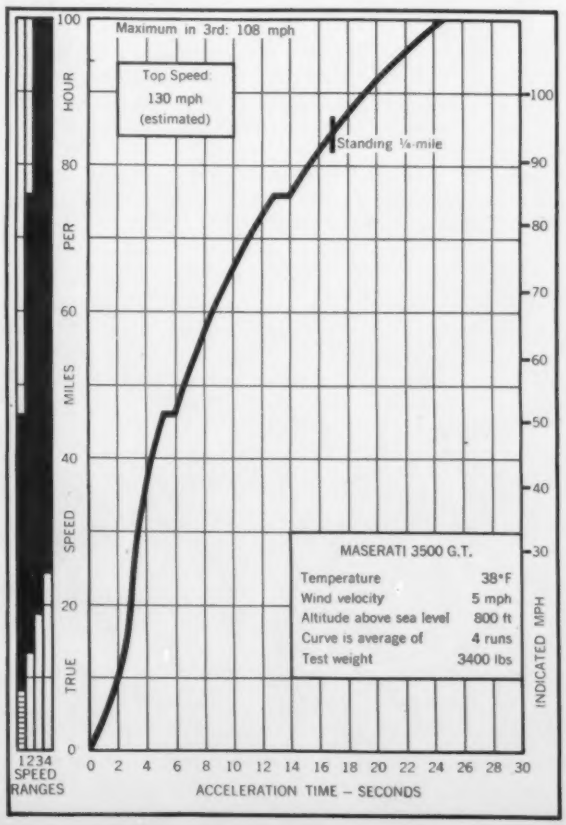
Gear	Synchro?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	3.18		11.24	—7.5
1st	Yes	3.00	63%	10.62	8.0
2nd	Yes	1.84	42%	6.51	13.1
3rd	Yes	1.30	30%	4.60	18.6
4th	Yes	1.00		3.54	24.2

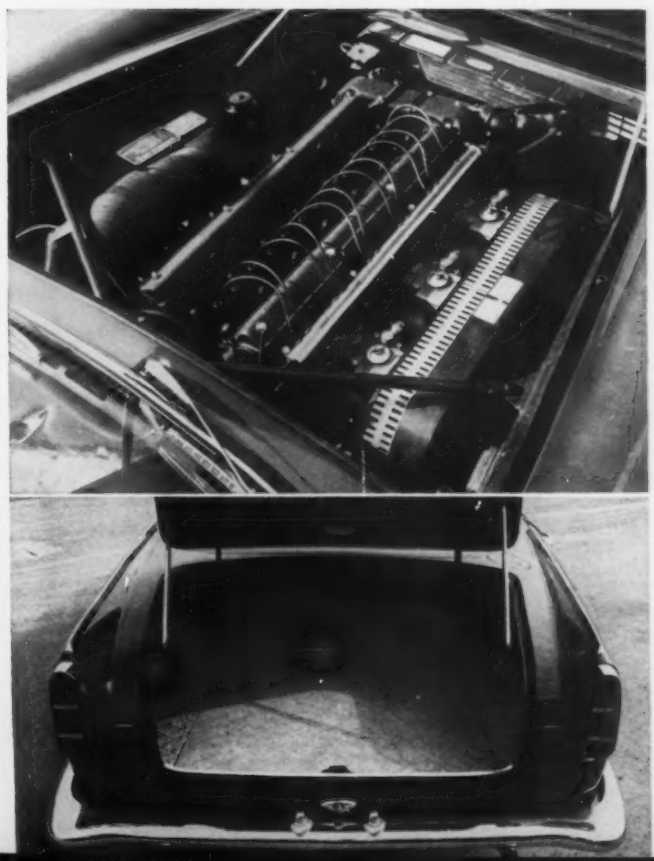
Final Drive Ratios: 3.54 to one std., 3.31, 3.77, 4.09 optional.



1 Speedometer
2 Tachometer
3 Water temperature
4 Fuel gauge
5 Oil pressure
6 Turn signal light (red)
7 High beam light (blue)
8 Lights-on light (green)
9 Generator light (red)
10 Ignition/starter switch
11 Windshield washer
12 Turn signal lever/dipswitch
13 Headlight switch
14 Driver's fresh air vent, fan
15 Heater/defroster vent, fan
16 Passenger's fresh air, engine compartment vent fan
17 Temperature control (raised—high; depressed—low)
18 Fan 14 indicator light (yellow)
19 Fan 15 indicator light (yellow)
20 Fan 16 indicator light (yellow)
21 Cigarette lighter
22 Hood release
23 Odometer reset
24 Windshield wipers
25 Interior light switch
26 Fog light switch
27 Handbrake
28 Choke


MASERATI
3500 G.T. Coupe
SCALE: EACH SQUARE ON DRAWING REPRESENTS ONE SQUARE FOOT
CAR and DRIVER
T·E·FORNANDER


Maximum in 3rd: 108 mph
Top Speed: 130 mph (estimated)
Standing ¼-mile
MASERATI 3500 G.T.
Temperature 38°F
Wind velocity 5 mph
Altitude above sea level 800 ft
Curve is average of 4 runs
Test weight 3400 lbs
TRUE SPEED MILES PER HOUR
INDICATED MPH
1234 SPEED RANGES
ACCELERATION TIME – SECONDS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
0 20 40 60 80 100
30 40 50 60 70 80 90 100



BRABHAM'S BRICKMOBILE

by Dennis May

One if by land, two if by sea and three if by Cooper should be the battle cry as the British prepare a single-car invasion of the Indianapolis classic.

► Following a brief but encouraging Indianapolis reconnaissance last October by Jack Brabham and John Cooper, during which the World Champion, a total stranger to the track, confounded established theory by turning a 144.834 mph lap on an under-engined and supposedly "unsuitable" Formula 1 Cooper-Climax, speculation concerning Cooper/Brabham plans, if any, for a veritable 500 entry in '61 were rife for months in Britain. Well, now we know: the entry is filed and, by the time you read this, the car should be at the Speedway for the first of two pre-race sorties. The schedule budgets for a testing session starting May 1, then a quick dash home for any necessary rectifications pending official qualification attempts around May 13/14.

Basis of the Indy Cooper is a fractionally lengthened tubular space frame with built-in assymetry to bias the weight heavily to leftward. The rear-mounted Coventry Climax engine is canted appreciably a-port, thereby reversing the normal inclination, and shifted to the left of the car's centerline. The chassis itself is offset in the same direction by appropriate extensions/retractions of the front and rear wishbone pivot lugs, and the radiator joins in the general migration. Finally, the larger of the two pontoon fuel tanks (total capacity, 34 U.S. gallons) is hung at left. The chassis offset brings the driver's seat off center too, of course – by around one inch, all of which should make the car handle.

Most of the rest is new. Body contours are revised to bring frontal area down slightly. Spring rates are changed. The familiar magnesium alloy wheels with stud attachment give place to Dunlop wheels of the pierced disc type, *à la* D-Jaguar, with centerlock fixing; these are stronger than the G.P. counterparts and anyway are necessitated by the obvious impossibility of going through on one set of tires.

Three tire changes are scheduled and Dunlop is bending its brains to the production of special casings for the quite unfamilar conditions. Last October, on road-racing Dunlops, front pairs were only lasting twelve laps, but apart from any improvement in wearing qualities resulting from Dunlop researches, the new weight bias will give the tires an easier time.

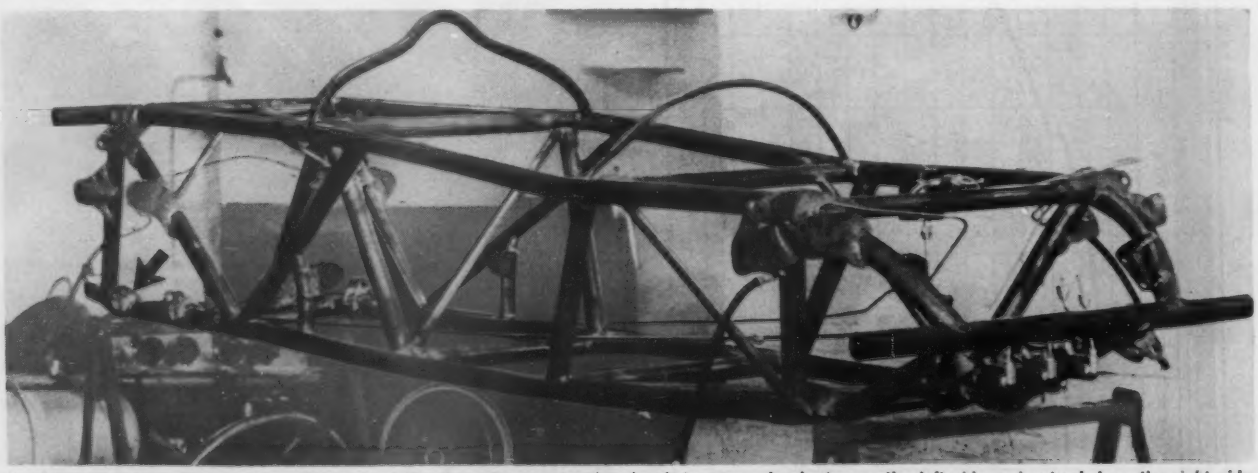
Worst of Cooper's worries is liable to be lack of proper testing facilities in England. Only one British track with any pretensions to suitability exists, the Society of Motor Manufacturers and Traders' banked MIRA circuit at Lindley, Warwickshire, but this has always been strictly a members-only preserve – Cooper isn't a member. At press-time, however, he was angling for a special dispensation. The MIRA banking is much steeper and higher than Indy's, but John thinks Brickyard conditions could be approximately simulated by keeping low on the banks.

Evidence of at least one SMMT member firm's estimate of the importance of Cooper's Indianapolis venture is seen in the decision of Coventry Climax to upscale one of its 2½-liter engines to 2.75 liters, specially for the Five Hundred. Growth of the Indianapolis Climax is two-dimensional, the bore going up from 3.7 to 3.78 inches, stroke from 3.54 to 3.74. To take advantage of a switch from straight gas to a 50/50 methanol/gas mixture, compression ratio is conservatively increased from 11.9 to one to around 13 to one. These and complementary developments raise power output by some 20 bhp – from 240-ish at 6750 rpm to an estimated 260 at 6000. Relative torque figures are 215 and 245 pound-feet.

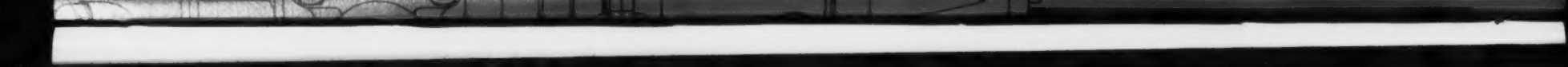
A special USAC waiver allowed Cooper to race a 92-inch-wheelbase chassis. Normal minimum at Indy is 96 inches. At ninety-two, this Cooper's w.b. is only one inch longer than the 1960 Formula 1 car's.

Weight is reduced in some departments – as by the use of a 3-speed instead of the normal 5-speed gearbox – and upped in others; knock-on wheels, bigger tires and double-capacity fuel tanks all add poundage. On balance, due mainly to the extra fuel load, start-line weight is above F.1 level at around 1200 pounds. Tires for Indy are 7.00 x 16 inch rear, 5.50 x 16 front; corresponding G.P. sizes in 1960 were 6.50 x 15 and 5.00 x 15 respectively.

BEN JAFIELD



Careful observation of rear of new frame (to left) shows how suspension brackets are made shorter on the left side and extended on the right side.

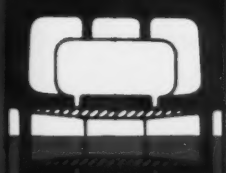


Part Four in this lovingly crafted series describes the incomparable Miller 91 engine and its beginnings in the mind of Harry A. Miller.

PROJECT
TIME MACHINE

THE ENGINE

by Griff Borgeson



► The first installment of this series appeared in SCI, January, 1960. It dealt with the background and acquisition of two of the finest pure-bred machines in American racing history — the front-drive Miller 91 Packard Cable Specials of the late 1920s. In July, 1960 we described the 91 chassis and the first stage of the restoration of these historic cars. In August, 1960 Part III was sub-titled "The Magic of a Name" and described the Olympian heights of racing achievement reached by Gwenda Stewart, *née* Glubb, with the front-drive Derby Miller and the recovery of that historic car's engine.

Project Time Machine may have languished from the reader's viewpoint but has actually been progressing at a healthy rate. Since the machines are unique and their restoration must be fitted into an all-too busy schedule no deadlines have been set; the job will be done painstakingly, thoroughly and, we trust, perfectly. Here, in Part IV, we take up the subject of the Miller 91 engine and its place in racing history.

CARBURETORS CAME FIRST

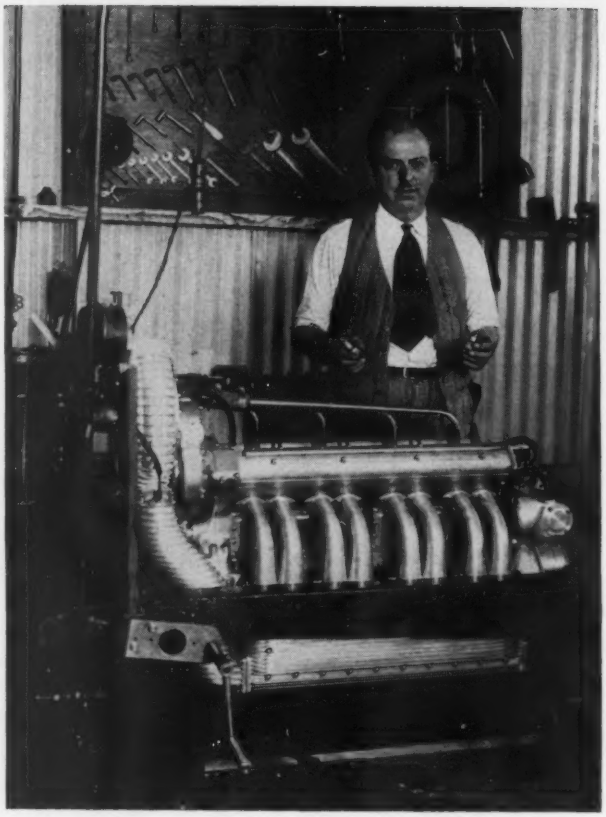
Harry Armenius Miller was too busy working with machinery to go to high school. From his home in Wisconsin he landed in Los Angeles in 1895 at the age of 19. He promptly went into the speed equipment business making racing parts for bicycles. In 1905 he built his first automobile; it had no transmission and an in-out clutch. His widow, Edna, remembers clutching their baby to her bosom every time they went for a ride. "I kept telling Harry he could be a great success like Ford, or Olds," she recalls, "but he wasn't interested."

He was interested in carburetion problems and about 1910 he designed and patented the Miller carburetor, which he manufactured successfully in a backyard open shed. Outside capital bought in and the renamed Master Carburetor flourished. About 1914 Miller sold his interest in this firm and formed the Miller Carburetor Co. First the Automatic model and then the Type H which was well received and Miller soon was producing over 5000 carbs per month. To this line of products he added his "alloyanum" pistons, perhaps the first light-alloy pistons manufactured in the U.S. There was a great deal of automobile racing in Southern California in those days and these Miller products became favorites with the bulk of the racing fraternity, which came to use the shop at Maple and Washington Streets as its headquarters. Thus Miller came to know practically everyone in racing and his machine shop facilities came to be used for racing engine work. Shop foreman was a young journeyman machinist from the Pacific Electric Railway shops named Fred Offenhauser.

STRAIGHT-EIGHT ORIGINS

Many cars and engines were worked on at the Miller plant, including Daimler Mercedes, Fiat and, fatefully, Peugeot. In SCI for October, 1956 we spelled out and showed graphically the evolution of Bugatti, Peugeot, Ballot, Sunbeam, Duesenberg and Miller engines and the cross-fertilizations that took place between these distinct strains.

Stated as briefly as possible, Ernest Henri designed the 1912-13 four-cylinder Peugeots in which were found a barrel crankcase (in which the crankshaft and 360-degree main bearing webs are installed from the flywheel end), dual overhead cams, gear-tower cam drive and four-valve pent-roof combustion chambers. In 1913 Ettore Bugatti built the first in-line eight and in 1916 he designed a 16-cylinder aircraft engine with two parallel, vertical banks of eight cylinders each. These engines were manufactured in France, where Henri worked with them. They also were built in the U.S. in the plant in which Fred and August Duesenberg were working. Miller and Offenhauser also were there to provide carburetors and fuel pumps and to consult in their use. The result was that the straight-eight concept captured the imaginations of all who were exposed to the Bugatti engine.



Here's Mr. Miller. Spark plugs in hand, he's standing behind one of his way-out experimental engines, a 91-inch eight with novel intercooling.

In 1915 Miller and Offenhauser got the job of rebuilding Bob Burman's almost-totaled Peugeot engine. In 1916 Miller built his first, own engines. These had four cylinders, four valves per cylinder, and a barrel crankcase. Miller used a gear-train cam drive but deviated from Peugeot practice in using, for economy, a single overhead camshaft. The valves were actuated by means of rocker arms which bore directly on their stems. Six of these engines were made, four for airplanes and two for cars, one of which was Barney Oldfield's Golden Submarine. These engines were not distinguished for their performance.

DUESENBERGS' FIRST EIGHT

The Duesenberg brothers had been such successful builders of automotive racing engines (four-cylinder, walking-beam rocker arm type) that, when the U.S. entered World War I, they were pressed into the nation's service to produce aircaft versions of the same high-performance power plant. Racing was their life and the instant that peace seemed imminent they designed a new engine for the 303 cubic inch Formula which had just one year to run. It was a Bugatti-inspired straight-eight. It had detachable cylinder heads; single overhead camshaft, driven by shaft and bevel gears; three slightly inclined valves per cylinder operated by rocker arms; barrel crankcase with only three main bearings. This successful engine was followed by one of similar design but tailored to the 183-cubic-inch Formula which prevailed in '21 and '22.

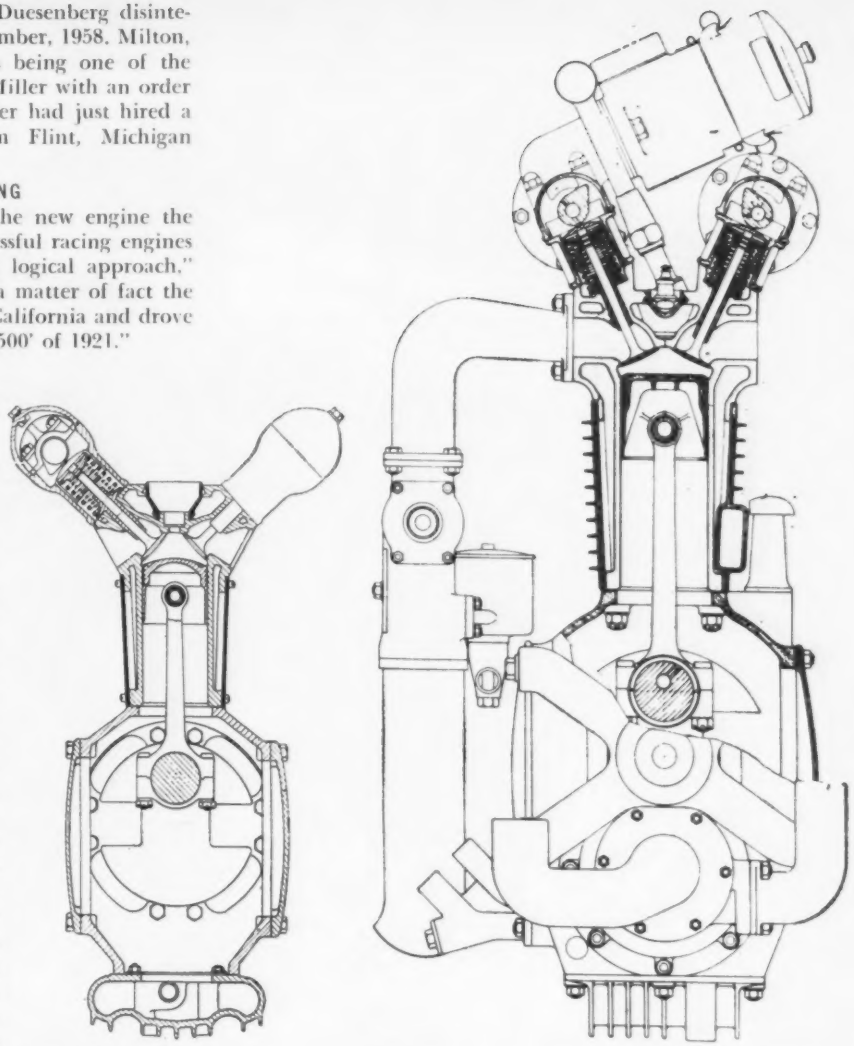
Henri, in France, had duplicated the Duesenbergs' enterprise. Immediately after the armistice he drew up a new machine for Ballot in which were combined his Peugeot constellation of design features along with the in-line eight layout and with piston or cup-type cam followers which seem to have originated with Hispano-Suiza aircraft V8s during World War I.

Tommy Milton's relations with Fred Duesenberg disintegrated in 1920, as described in SCI, November, 1958. Milton, then the holder of the LSR as well as being one of the greatest names in track racing, went to Miller with an order for an engine to beat the Duesies. Miller had just hired a gifted young ex-Buick draftsman from Flint, Michigan named Leo Goossen.

THE BEST OF EVERYTHING

This team agreed to incorporate in the new engine the seemingly best features of the most successful racing engines of the day. "That sounds like a pretty logical approach," says Milton, "but it didn't pan out. As a matter of fact the result was so poor that I left the car in California and drove a Frontenac for Louis Chevrolet in the '500' of 1921."

This ugly duckling of an engine borrowed heavily from Duesenberg design, was a straight-eight with only three main bearings and with an exact copy of the Dues' dry-sump lube system except for Miller's improved, compact oil pump. In place of Dues' one intake and two exhaust valves per cylinder and fragile, Y-shaped roller cam followers Miller took the Henri-Hispano route, using gear-driven overhead cams, cup-type followers and four valves per cylinder in pent-roof chambers, inclined at a 60-degree included angle. As first laid out, this engine's cam drive was to employ a radical Miller idea: drive by connecting rods, *à la* modern NSU piston 'cycle-engine practice. But the concept was too speculative and conventional spur gears were substituted. The first two engines (driver Ira Vail ordered the second one), like Dues, had detachable cylinder heads and ball bearing rear mains. They also aped the Duesenbergs with their 4-4 crankshafts, like the two four-cylinder cranks butted together, as opposed to the 2-4-2 layout of production-car practice. These Miller cranks were balanced statically but not dynamically.



The left-hand section shows the Miller 91 engine, in an early incarnation. To the right is its grandpappy, the 183-inch Miller, with its four-valve pent-roof head. Both are to one-sixth scale.

Vail's experience with the second engine paralleled Milton's with the first: the engines ran but their power output was very inadequate. Both of these early Miller clients deduced that the problem was cam design.

CAM FORM REFINEMENT

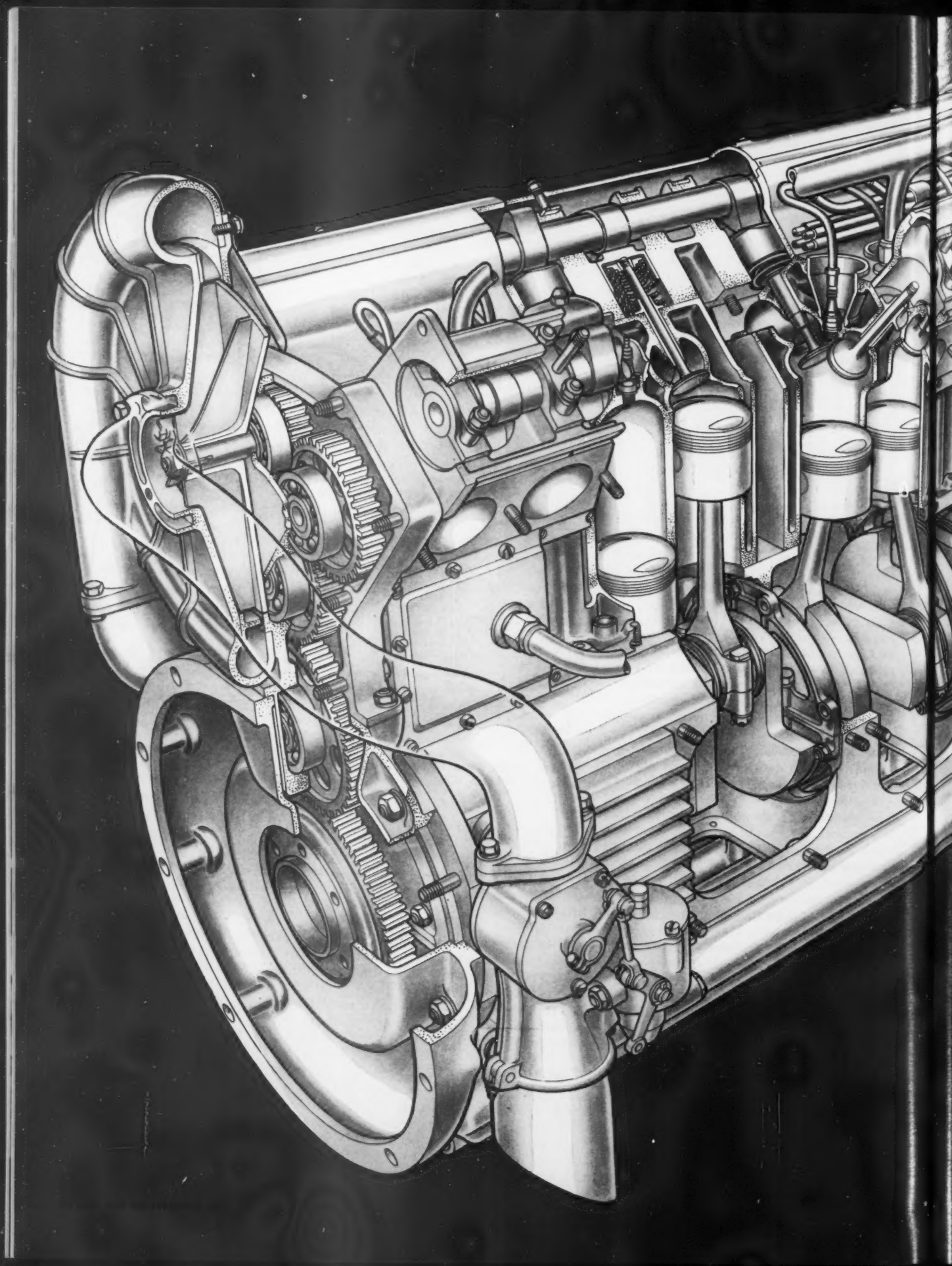
Miller's design team and Milton continued to develop the engine in 1921. In that year Duesenberg was having serious troubles with valve spring breakage and took his problem to Col. Hall of the Hall-Scott marine engine works in Berkeley, California. Racing-enthusiast engineer Hall first designed a test machine with which he determined that accelerations with the Dues' cam were so great that a spring could be broken in as little as one-half cycle of operation. Hall then designed a revolutionary cam profile which not only cured the spring failure but also resulted in a spectacular increase in bhp. Duesies were more successful than ever.

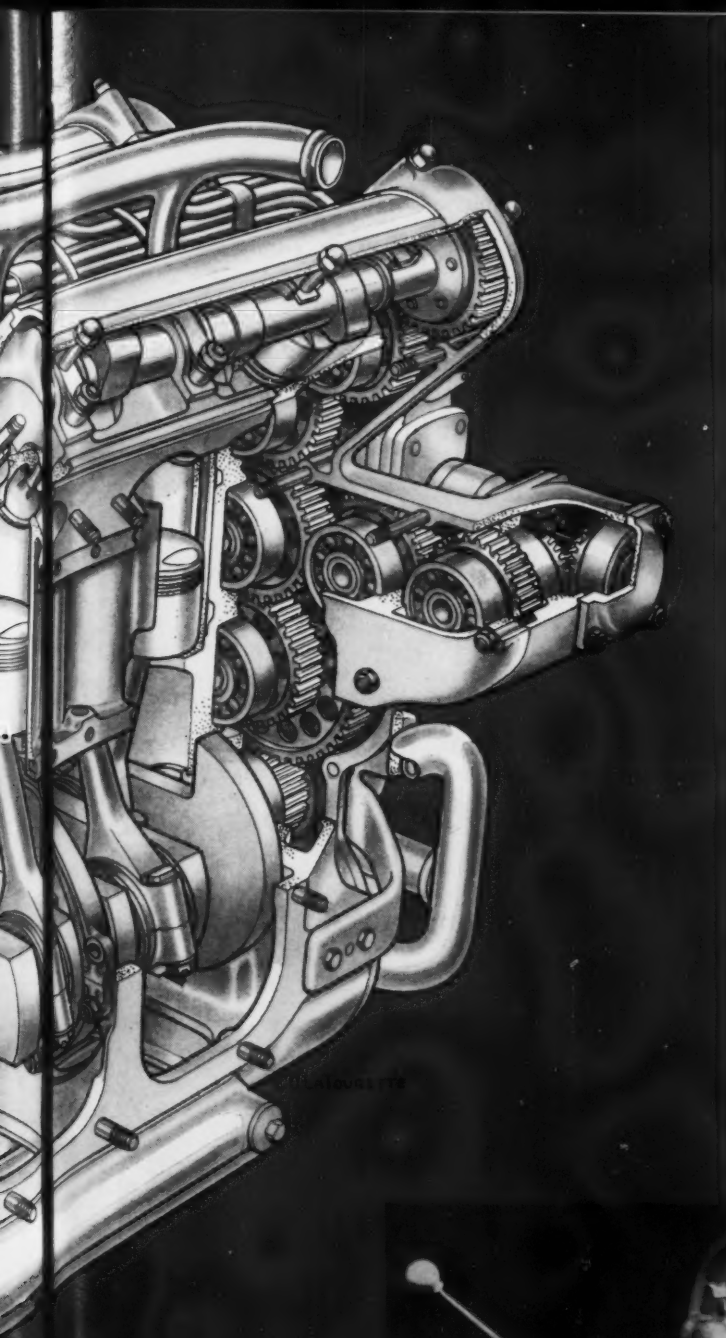
Milton, true to the concept of using the best of all ideas, still had friends in Dues' employ who were good enough — from his point of view — to forward him engineering drawings of the Hall cam. Because Dues used roller rocker arms and Miller used cups a very different cam had to be designed to provide the same operating characteristics. Goossen made the translation successfully with his first try and it was this which unlocked the Miller eight's power potential. Like the Duesies, the Milton and Vail machines began running like mad and it was only a short time until Jimmy Murphy and Harry Hartz purchased Miller engines which they installed in their Grand Prix Duesenberg chassis. This was the combination with which Murphy won the 1922 "500," set a new record for the distance and launched Miller as a national figure.

Milton's Miller engine gave no trouble in that race but he was forced out by a broken fuel tank mount. The situation was fraught with irony. Milton and Murphy were bitter rivals at the time but Murphy won the big race — and purse — with an engine that Milton largely had created. Formerly like father and son, Milton had split with Murphy because of favoritism toward the younger driver by Duesenberg. And from Duesenberg's point of view, Murphy's switch to a Miller engine must have been a very bitter blow.

DEVELOPING THE 183

About twelve 183-cubic-inch Miller eights were built. Bore and stroke were 2 11/16 by 4.0 inches and compression ratios ran between 7.5 and eight to one. Running on gasoline with some benzole they developed about 125 bhp at 4000 rpm, equal to a corrected piston speed of 2190 ft./min. Lessons were learned quickly from the first two 183s. The detachable cylinder heads were replaced with integral ones to eliminate gasket problems and to improve core control, *à la* Peugeot





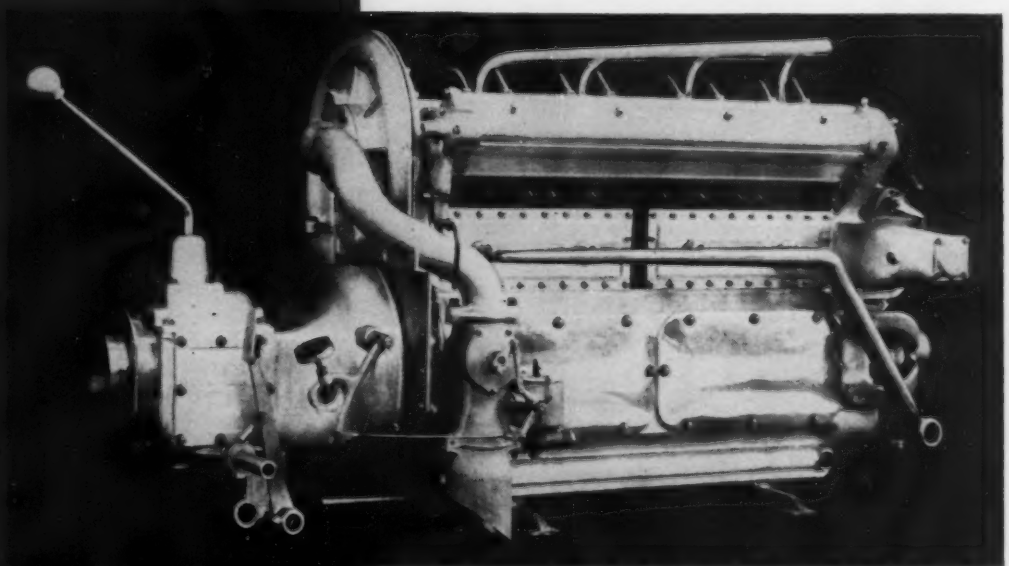
and Bugatti. Integral spark plug bosses were replaced by cup-type inserts (as used on today's Offies) for improved core control. The ball rear main bearing was replaced by a more reliable poured bearing. The original cranks carried no counterweights and broke with perfectly timed regularity. A Cal Tech professor, C. V. Elliott — brother of Frank Elliott, the driver who had taken over the Vail engine, suggested counterweights as used in his new Hudson Super Six. He calculated the weights for the Miller 183 and this corrected the crankshaft failure problem.

Intake and exhaust valves had 1 3/16-inch-diameter heads and the intake passages were cored to receive 1½-inch Miller carbs. Most of the early engines were fitted with four inlet manifolds feeding two cylinders each and using four single carbs. Milton was responsible for the later trend to eight separate inlet manifolds connected to four Miller two-throat carbs. The first engines ran a vertical generator; this was abandoned in favor of battery alone which then was succeeded by Robert Bosch magneto.

The camshafts, cam housing and covers on the 183s were each made in two pieces simply because of the small size of Miller's machine tools at that time. Aside from such details the 183 was spectacularly similar to current Offies. Among the points of similarity are: barrel crankcase with hand holes; four-armed, bronze, spigoted front engine support; method of attaching blocks to case invisibly by means of studs in blocks which enter case; radiused-cup cam followers and nested valve springs; cups keyed to prevent rotation; cam and accessory drive.

SCALED DOWN TO TWO LITERS

The last year of the 183-cubic-inch Formula was 1922 and in the summer of that year work commenced on the Miller 122; about ten engines started the 1923 season. These were scaled-down 183s with a few very important differences. First was the change from a three to a five main-bearing crank, using a ball bearing on the flywheel end again. More important was the adoption of the true, 180-degree, hemispherical combustion chamber in which the valves were inclined at an included angle of 90 degrees. While this shape had been used much earlier in Europe, Miller seems to have been the first to use it in a legitimate racing engine. The idea, again, came from Col. Hall, via Tommy Milton. While it involved a sacrifice in port area (*Continued on page 97*)



Both 91s shown here, above and in cutaway, are set up for a rear-drive chassis. Engine above is an early unit, complete with gearbox, while La Tourette shows a later version with ribbed side plates and blower.

CHRYSLER'S TURBINE FOR TODAY!

by Karl Ludvigsen

A radical Chrysler development has tamed the turbine. Against the Wankel engine and this kind of competition it's no longer a question of which will win, but how long the ninety-nine year-old piston engine will last!

Always a pioneer in the use of gas turbines in automobiles, Chrysler recently unveiled a brand-new pinwheel powerplant that's closer than ever to the production line. It's a completely new unit with an important new feature that makes major inroads on three chronic turbine ailments: poor fuel economy, delay in acceleration, and lack of engine braking. It's called a "variable second-stage nozzle mechanism," and in general it is to the turbine what the invention of the throttle or the positively-operated intake valve was to the piston engine! Before we examine the latest engine and take a ride in a turbine Plymouth, let's look back at the origins of this exciting program.

IMPETUS: GEORGE HUEBNER

Behind all Chrysler's turbine work stands the figure of George J. Huebner, Jr. — executive engineer in charge of research. Now in his thirtieth year with Chrysler, Huebner speaks quietly but with authority and precision on research, and with enthusiasm on turbines. His thatch of gray hair is a recent arrival, spreading from the temples during the last five years when he's been most embroiled with the job of making the turbine perform!

Before the war, George Huebner made a brief survey of gas turbines for cars, but concluded then that neither materials nor techniques were sufficiently advanced to make research worthwhile. The war changed that, of course, and in 1945 Chrysler began laying out experimental automotive turbine designs. All of them included a heat exchanger, to return some of the heat energy of the exhaust to the compressor cycle, to bring the turbine's fuel consumption into the automotive area.

EARLY AIRCRAFT DESIGN

None of these early engines were built, for the Navy found out about Huebner's designs and contracted with Chrysler, in late 1945, for the development of an aircraft turboprop engine that would match the part-load economy of a piston engine — then an unheard-of requirement, since all earlier aircraft turbines had been most economical at peak power only. Specifically the Navy wanted a 1000-horsepower turbine with a b.s.f.c. (brake specific fuel consumption) of 0.52 pounds per horsepower-hour at 70-percent power. The design was completed in 1947 and the engine first ran in May of 1948, reaching its design goals soon thereafter. Budget restrictions forced the Navy to drop the project before the engine could be flown, but after this design success, George Huebner said, "from then on we were sold on turbines right to the hilt."

The heat exchanger used in the aircraft turbine was a conventional radiator-type unit known in turbine talk as a "recuperator". It returned a maximum of 70 percent of the exhaust heat to the engine cycle, which was adequate for limited conditions but not for the wide range of an automotive powerplant, which spends most of its life working at about a quarter of its capacity. Huebner's group set a new efficiency goal of 85 percent, which no conventional recuperator could meet. As Huebner said then, "Such a heat exchanger would easily have filled a house trailer or certainly would have occupied all the passenger compartment except — possibly — the driver's seat. A completely radical approach became necessary." It was found in the device turbine men call a "regenerator."

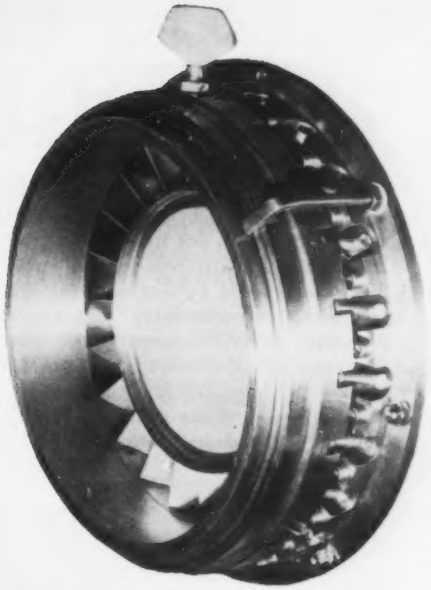
WHAT'S A REGENERATOR?

A conventional heat exchanger, like a car radiator, separates the hot and cold fluids or gases with a metal wall, through which heat must travel. This places a strict limit on the amount of heat that can be exchanged efficiently with an ordinary "recuperator." Is there another way to do it? Yes. Instead of boiling it in a pot on the stove (analogous to the "recuperator") water could be heated by warming a poker in the oven, then plunging it into the liquid. The same metal surface is involved in the transfer; heat doesn't have to flow through metal from one surface to another. Handled properly, it's a more efficient heat exchange system, termed "regeneration."

Steam car enthusiasts, take heart! With its welded steel case, the new turbine has a boiler-room look. Two big cylindrical air cleaners sit horizontally just behind the mildly restyled grille.

In terms of hardware, a regenerator revolves a metal mesh or matrix through ducts that carry the gases that must exchange heat. Naturally these ducts must be sealed off as completely as possible from each other, since any substantial crossover will defeat the purpose of the regenerator. In the turbine, heat is to flow from (*Continued overleaf*)

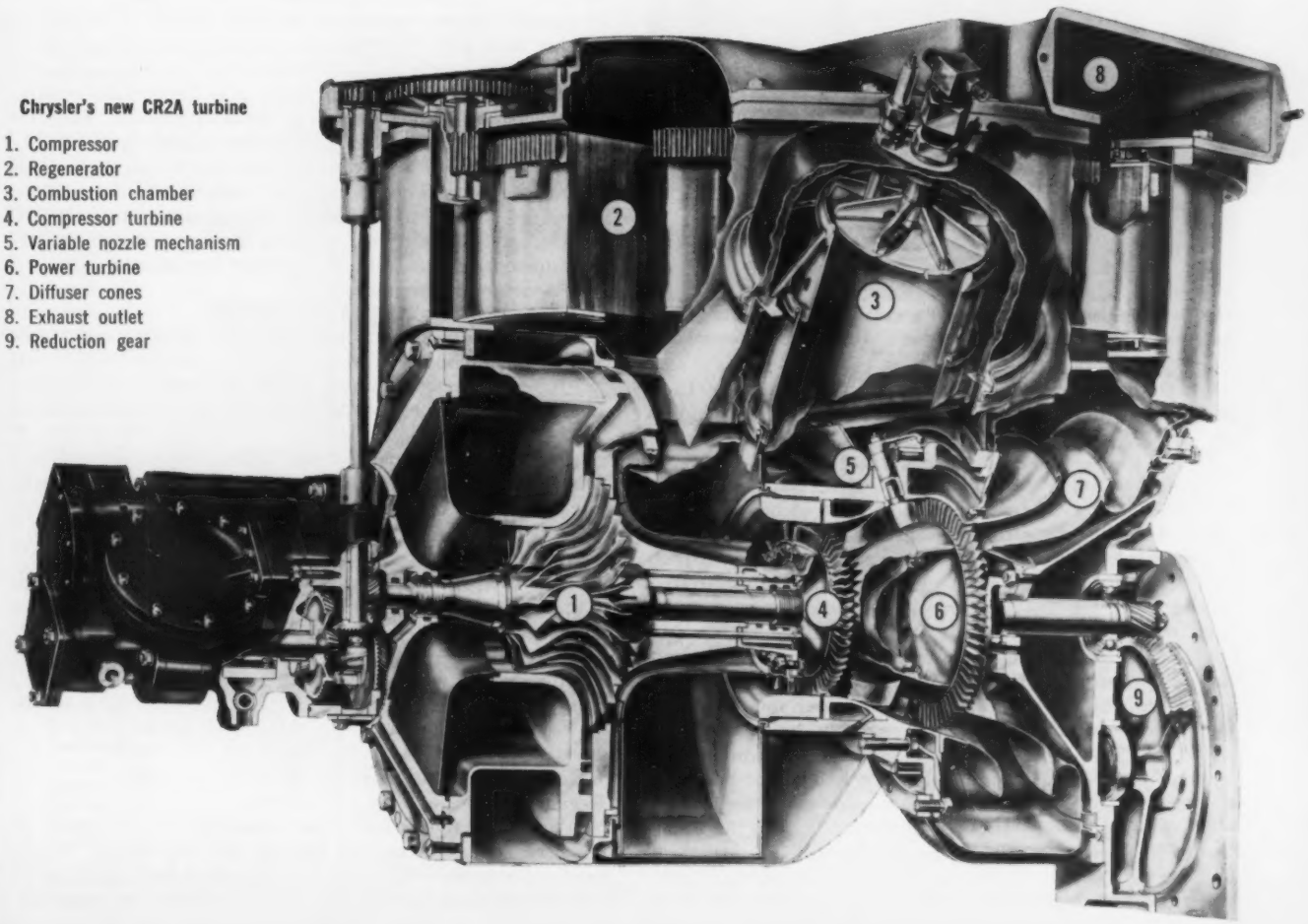
George J. Huebner, Jr. probably has more mileage behind the wheels of turbine-powered cars than any other American engineer. Modified dashboard of experimental Plymouth X7 is visible here.



Assembly above is early variable-nozzle ring, placed between compressor and power turbines and marked by key 5 below. On this display unit the vanes or "nozzles" are actuated by turning the control ring — and thus the vane levers — by moving the white knob at the top.

Chrysler's new CR2A turbine

1. Compressor
2. Regenerator
3. Combustion chamber
4. Compressor turbine
5. Variable nozzle mechanism
6. Power turbine
7. Diffuser cones
8. Exhaust outlet
9. Reduction gear



the hot (about 1250°) but low-pressure exhaust gases to the cooler (about 350°) but high-pressure air being pumped to the burner by the compressor. A regenerator's rotating matrix can be either drum-shaped or disc-shaped. G.M. eventually chose the drum for the Firebird turbines (two, one on each side) while Chrysler chose the disc, as did Ford, experimentally.

During the early fifties George Huebner was primarily concerned with Chrysler's gigantic Redstone missile production program, but his staff was able to make steady progress toward its first regenerative turbine. They managed to meet and exceed by one percent their 85 percent efficiency goal for the regenerator, and the installation in a 1954 Plymouth Belvedere sport coupe was successful enough to warrant a public announcement on March 25, 1954. Designed to give 100 bhp, this first engine actually produced 120 and yielded fuel economy comparable with contemporary piston engines — quoted as "between 15 and 20 mpg." It was a sensational announcement that, to many, made turbines seem much closer to production than was actually the case. Basic obstacles of design, materials and fabrication still stood in the way.

Nice detail engineering throughout Plymouth X7 includes twin exhaust ducts aimed downward behind rear wheels. The chassis is conventional.

FURTHER FORWARD STEPS

Transferred to a 1955 Plymouth sedan, this engine continued to yield vital research data in spite of being, according to Huebner, "a rather primitive design for its state of development." Huebner was able to get back from missiles to turbines in late 1955, a time he regards as the real beginning of Chrysler's serious research on the automotive turbine. Early next year Huebner rode as copilot in a New York to Los Angeles endurance run in a 1956 Plymouth powered by this "primitive" turbine. Failures were non-critical: overheated reduction gear bearing, and cracked intake casing. The principle was proved; it was time to build a new turbine.

1957 and 1958 went by in the design, construction and development of a bigger engine that received major publicity in January, 1959 when it made an economy run from Detroit to Woodbridge, New Jersey and back. Encased in a '59 Plymouth, it returned 19.39 mpg on the way out, at a 38.3 mph average, and 17.17 mpg at 51.65 mph on the way back. It performed impartially on diesel oil, jet fuel and both white and leaded gasoline. Shaft output was 225 bhp, exactly the same as the G.M.-Allison GMT-305 turbine being publicized in 1959, though the Chrysler unit ran at a lower temperature (1600° against 1650°) and got fractionally better specific fuel economy (0.54 pounds/bhp-hour against 0.55). It almost smacked of 1951, when Chrysler picked Cadillac's dimensions for its new V8 — then got 20 extra horses out of it!

CRACKING THE ALLOY PROBLEM

By 1959 Huebner and his men were well along on two new high-temperature alloys that would reduce the turbine's appetite for rare and expensive elements. One was suited to low-stressed but hot parts, like the combustion chamber liner; the other was tremendously promising for turbine wheels and blades. What's it composed of? "Over 85 percent iron," Huebner says, "no cobalt, a reasonably low amount of nickel (as a matter of fact, I probably have enough nickels in my pocket for several passenger cars) and just a pinch of this and that. The 'this and that' is readily available under normal conditions and even fairly available in wartime." It's much less brittle than the more usual cobalt alloys, as easy to weld and easier to cast, making it possible to cast turbine blades integral with their wheels.

This alloy isn't the end of the line, either. "We're working on a combination now that will allow us to use temperatures of 2100° F.," Huebner says, "which will give us 40 percent more power and 25 percent better economy."

The 225-horse turbine was a development workhorse for other techniques. One turbine drawback had always been the leisurely rate of acceleration of the compressor section — the single-shaft assembly of centrifugal compressor, burner and axial turbine that produces hot gas to drive the axial power turbine. It's also called the gas generator or "gasifier", a G.M. term. The turbine doesn't deliver solid power until the gasifier is near peak rpm, which is usually 20-30,000 rpm higher than idle! Chrysler's first turbine took 7-8 seconds to accelerate from idle to peak, introducing a serious control lag.

One way to minimize the delay is to reduce the rotating inertia of the gasifier section as much as possible. Keep the shafts light and impeller and turbine diameters small. To reduce gasifier turbine size, Chrysler engineers made it do more work by hiking gas speeds across the blades into the transonic region — at and above the speed of sound. By this means, and by the first experimental application of the variable-nozzle principle, the gasifier acceleration time was cut to only three seconds.

THE LATEST TURBINE

All these experimental advances were incorporated in the design of Huebner's third car turbine, a smaller engine that was intended to be as near a production unit as possible. It's the engine in experimental Plymouth X7, known as model CR2A.

Chrysler's design goals for the CR2A compare interestingly with the performance actually achieved. This tabulation tells the story:

	PROJECTED	ACTUAL
Output	140 bhp	140 bhp
Specific fuel consumption	0.46 lb/bhp-hr	0.51 lb/bhp-hr
Turbine inlet temperature	1600°	1700°
Compressor air flow	2.0 lb/sec	2.2 lb/sec
Pressure ratio	4.30 to one	4.25 to one
Compressor efficiency	80%	80%
Compressor turbine efficiency	87%	87%
Power turbine efficiency	84%	84%
Burner efficiency	95%	95%
Regenerator effectiveness	92%	90%
Regenerator leakage	3.9%	4%

You'll note that the actual fuel consumption isn't quite as good as projected, mainly because the regenerator wasn't as effective in the engine as component tests had indicated. It had also become possible to use (*Continued on page 87*)

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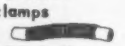

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AUGIE'S ALWAYS READY TO WIN

Continued from page 32

has entered, a record any driver would envy.

Augie's first contact with road racing was watching Jim Kimberly and Fred Wacker thunder about the old Elkhart Lake and Janesville circuits in Wisconsin. In the summer of 1956 Augie decided to have a go at it himself. There was considerable family resistance. Adding to the usual misgivings were the circumstances of his father's death and the fact Augie is an only child. But he persisted and bought a TR3. In his first race, at Elkhart Lake, he was soundly beaten by Ernie Erickson in an A.C. Bristol. It didn't look like Augie could be ready to win in the TR3 — so that winter he bought the Bristol. Augie was now ready to win.

With the Bristol meticulously prepared he was beaten only once or twice during 1957 in SCCA and MG Car Club events. In the spring of 1958 he bought from Jimmy Johnston the ex-Ebby Lunken 2.5 Ferrari. Again he was ready to win and again he did. During 1958 he was racing on every conceivable opportunity and in 1959 he joined USAC so he could race some more. "It's the only way to get better," he says.

Augie's fling with the pros went well from the start. He opened with a third at Daytona Beach in a vintage D-Jag, then drove his Ferrari to a third and a second in big races at Meadowdale. At this point Augie got a car from the "wrong" beer works. "It was sort of funny the way it happened," he says. "That spring the Peter Hand Brewery had decided to go racing. They bought an XP5 Bocar and Harry Heuer Jr. drove it. Then in August they bought the No. 3 Scarab. Harry Jr. called me and asked if I knew where he could get ahold of Paul O'Shea. I knew where Paul was but I also knew he was committed to drive a Sadler. So I asked Harry why he was looking for Paul. When he told me I explained about Paul but said I knew somebody who would love to drive the Scarab and his name was Pabst. Harry was amazed. He said it had never occurred to them that a Pabst would drive for the Peter Hand Brewery. I said this one certainly would!"

Anybody would snap up an offer to drive a Scarab but Augie had reason to snap faster than most. His second at Meadowdale had been to Jim Jeffords in another Scarab and Augie had realized that if he wanted to be — as grandfather had insisted — ready to win, the Scarab was the car to do it in. His first ride was a shaky one. "We tried out the car at Meadowdale in midweek. Nobody on the crew knew anything about it and when they fired it up I was pretty impressed. I got in and really took it easy. I'd never sat behind that much power in my life. I'd push the accelerator just a tiny bit, then back off. I was sort of awed by the whole thing. I finally got up my nerve and pushed a little harder. Right then the throttle stuck and I damn near demolished the car and myself. It scared the hell out of me."

The fright subsided enough for him to win an SCCA regional at Milwaukee and bowl over a USAC Formula Libre entry at Meadowdale that included Rodger Ward, Lloyd Ruby, Paul O'Shea, Zora Arkus-Duntov in a Formula I Maserati . . . and Jim Jeffords in a Scarab. He journeyed west and won at Vaca Valley and finished ninth at Riverside, after being involved in the Dan Gurney grid accident and being socked with a long penalty which still galls him. At Nassau he finished out the season as USAC champion with a mishap in which he sees more humor. The trailer carrying the Scarab dove off a cliff in Virginia so Augie drove the Bocar. He was first off the mark, first through turn one, first through turn two . . . and last through turn three. Somebody forgot to clean the fuel filter.

During 1960 Augie again wrote an impressive list of victories, but not long enough to win the USAC championship. And the year was significant for a couple of events he didn't win. One was a 250-mile stock car race at Milwaukee. He had never before raced a stock car but he took one owned by Rodger Ward and qualified it 11th. At the start, Augie says, "I was scared stiff. I thought those guys would run over the top of me so I pulled a little wide and bang I was 17th." Again he overcame his misgivings in short order and fought his way to fourth before a hanging shackle blew out a tire for the first of three times. After the third blowout Augie called it quits.

The second big event in 1960 — "one of my biggest thrills" — wasn't even a race; merely some trips around a deserted circuit in a couple of old race cars. Augie was invited to the Mercedes factory and allowed to drive the Type W196 and 300SLR. It was more than something special for Augie; his German ancestry, the fact Pabst Motors, Inc. sells Mercedes and, most of all, Augie's inbred insistence on efficiency and meticulous attention to detail have caused him to raise the firm's racing efforts to a position rather closer to Heaven than earth.

The possibility of Mercedes returning to racing is a shaky foundation on which to build a career and Augie knows it. "I race," he says, "because I feel I'm accomplishing something myself. Sure I'd like to be the world champion. But I'll race another three years and if it doesn't look like I'm getting where I want to then I'll know I'm wasting my time. I like to hunt and fish and I'd like to take up polo. There are a lot of things I enjoy doing. Racing isn't my whole life." Augie has already done consistently well in championship competition: he has finished seventh and fourth at Sebring and seventh at Le Mans in his only three tries. But to blitz the big-time, Augie must buck odds that are high indeed. The same balanced attitude that has won him friends will put him at a disadvantage when competing with men to whom motor racing is indeed their whole lives. To beat these men of fierce determination Augie must develop a superior natural skill of the type offered by Portago and Brooks. A great many people hope he can do it. —*SMcN*

CHRYSLER'S TURBINE FOR TODAY

Continued from page 84

a higher peak temperature than had been thought likely when the CR2A was planned. The fuel economy achieved is still better than any competitive turbine engine can claim today, and as good as most piston engines over most of the operating range.

Regenerator design will still progress in search of that 92 percent effectiveness. The CR2A's regenerator disc is 21 inches across and 4½ inches thick, compared to 18 x 3½ inches for the original Chrysler regenerator, and 22 x 3 inches for an experimental Ford disc. On the Chrysler engine it rotates at about 17 rpm at peak gasifier revs which, you'll appreciate, involves a lot of reduction from 44,610 rpm! Its matrix is made of type 430 stainless steel, wound around a central core, and its through-passages are given the most miniscule aerodynamic study to reduce pressure loss to a minimum.

Originally the areas of the disc exposed to the hot/cold gases were proportioned 70/30, like most regenerators, but on the CR2A the ratio is 60/40. The 4 percent leakage shown on the tabulation is hard to reduce, since a certain amount of carry-over loss through the matrix passages is inevitable. Seals themselves present no problems. "As an example," George Huebner says, "we have a seal material that shows so little change after 1000 hours that we stopped running endurance tests with it. Perhaps in the next 1000 hours of running something startling may happen to it, but we doubt it."

REDUCTION OF INERTIA

More progress was made in reducing the inertia of the gasifier section, to cut down turbine acceleration time. Transonic blade design allowed the use of a compressor turbine wheel only 6¾ inches in diameter, while the centrifugal compressor wheel is 7⅛ inches across. The latter is now made of aluminum, though experiments are being made with magnesium, and with cutting away of the wheel surface to leave no more metal near the rim than is absolutely necessary. At peak gasifier rpm, the tip speeds of compressor and turbine respectively are 1390 and 1315 feet per second — both well above the speed of sound of about 1100 fps. Result: total acceleration time cut to 1½ seconds! It's still not so quick as a piston engine, but it's very, very close.

Detail development has thus been fruitful in regeneration and inertia reduction, but the big story in the CR2A is the perfection of the variable power turbine nozzle. Between the compressor turbine and power turbine — in any g.t. engine — there's a ring of stationary vanes that form "nozzles" that direct the hot gases at the power turbine blades at an angle that's optimum for engine performance. These nozzles could only be set in one position, which would be just right for one turbine operating speed but would be a compromise for all other conditions. This is

(*Continued on page 88*)

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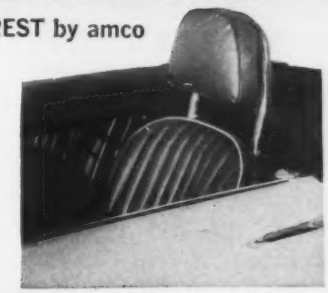

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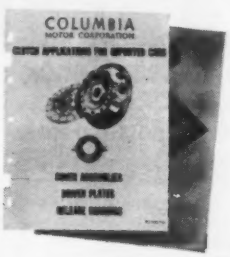

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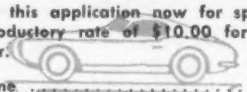

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(Continued from page 87)

okay for an aircraft turbine, with its very limited design speed range, but it hampered the creation of a versatile, wide-range automotive turbine.

ACCOMPLISHING THE IMPOSSIBLE

Could these nozzle vanes be made movable? Could Chrysler engineers "switch the pitch" to improve performance? These vanes work at temperatures between 1200 and 1700° F. No lubrication could be applied anywhere near them. Separating the vanes from their carrying rings introduced new problems of compatible expansion and contraction without binding. Any leakage meant reduced efficiency and added problems. Somehow they did it.

Only 23 vanes are used, quite a lot less than in a stationary nozzle ring. Each one pivots on a shaft that runs radially outward to a square end, to which a small lever is fitted. A round ball tip on this lever is engaged by a slot in a ring which runs around the whole nozzle assembly, picking up the levers from all the other vanes. Movement of this roller-bearinged ring thus moves the levers and swings the nozzle vanes back and fourth. It's mechanically simple but the metallurgy must be murder.

Early variable nozzles had only 80° of movement, which still opened new design vistas. An extreme, nearly-closed nozzle could be formed for maximum economy. A normal position could be assumed for best power. An open, straight-through nozzle was available for fastest gasifier acceleration. Manually operated, the variable nozzle contributed greatly to the fine fuel economy obtained in Huebner's 1959 demonstration run.

The CR2A, though, has a full 100° of movement which allows actual reversal of the nozzle angle to produce positive engine braking! The gas turbine has always been conspicuous for the absence of this useful characteristic; Chrysler has been able to design it in with the most fundamental possible technique — no extra ducts, dump valves, or reverse-direction clutches. The CR2A's nozzle control system has understandably not been described in any detail by Chrysler, but it's apparently sensitive both to throttle position and to gasifier rpm. Movement of the control ring is effected by a hydraulic cylinder, through a control system that draws from automatic transmission technique, "only simpler," Huebner hastens to add.

As the power curve shows, peak output appears at 4570 rpm and a maximum of 5360 shaft rpm are allowed. These correspond to 39,000 and 45,730 power turbine rpm, and to turbine tip speeds of 1255 and 1470 feet per second respectively, on the 7⅜-inch turbine wheel. The CR2A weighs 450 pounds, complete with all accessories and ready to install. Huebner's staff is now working on a dieting program, with light alloys, that will probably bring the figure down to 300 pounds. Maximum dimensions are 36 inches long, 35 wide (at the top only) and 27 high.

The CR2A is now installed in a 2½-ton Dodge truck and in a 1960 Plymouth four-door sedan named "X7" since it's the seventh such turbine car Chrysler has built and run. The center of its grille has been blanked out by a fiberglass nosepiece, to symbolize the turbine's independence of radiators, and it sports a handsome red stripe down its centerline. Lifting the hood reveals a shape that will delight steam car enthusiasts. The CR2A's simple, round outline looks like nothing more than a steamer's boiler! It's a valid comparison, too, for the turbine shares the steamer's impressive torque at zero shaft speed. Ahead of the engine is a wide case enclosing two big cylindrical Purolator air filters, with paper elements. A turbine's filtering needs aren't as demanding as those of a piston engine, so it's not difficult to provide the large volume of air it requires.

EXCITING SIGHTS AND SOUNDS

Let's climb aboard Plymouth X7 and go for a drive with George Huebner. He faces a restyled dash panel with four round dials. The two on the left offer no surprises, with info on generator charge, fuel level and car speed, but the two on the right are reserved for the space age motorist. One indicates engine oil pressure and the temperature at the power turbine nozzle — a range of 0-2000° F. is provided. The other shows gasifier speed in terms of percent of peak power rpm — 39,000 rpm in this case, as you'll recall. This relieves the pilot of the confusion of interpreting these astronomical rev numbers and gives him only the information he needs. Below the left-hand dial are four buttons to control the three-speed automatic gearbox used in X7. It's one of Chrysler's regular three-speeders, but without a torque converter or neutral position, neither being needed or desired by a turbine.

When Mr. Huebner inserts his key in the ignition and twists it to the right, 12 volt current courses through an Eemco starter-generator that's able to turn the gasifier up to 20,000 rpm if necessary. This time it isn't, for as the starter's whine cascades higher and higher it is joined by a deep rumbling sound that indicates the burner is lit. This voice of combustion is so muted that it's very similar, in volume and tone, to the sound of the Corvair's gas-fired heater. The starting sequence will have taken about eight seconds. If he desired, Mr. Huebner could now let the gasifier idle at its usual 40 percent of peak, or about 15,000 rpm. If he's out to impress you, which is more likely, he'll step right down and wheel X7 away at maximum power, for the gas turbine requires absolutely no warmup.

As this unique car swings into action, you begin to hear the fantastic automotive sounds of tomorrow. The main sound is the high whine of the gasifier section, steady at its peak controlled rpm at full throttle, or fluctuating up and down as throttle and power demands vary. Beneath this overlay you hear the deep whine of the power turbine section, steadily rising and falling as car speed varies and the gearbox shifts. Backed by the rumbling bass of the burner, these high notes weave and interlace a magnificent musical tapestry of the sound of the space age.

George Huebner is quick to point out that the high whining sounds of the CR2A engine are produced by the hand-machined gear trains and would be vastly reduced in a quantity-produced turbine. In the

case of the gasifier it's the helical and bevel gearing to the accessories and regenerator; in the power section it's the reduction gear, which had a particularly loud period on X7 at about 30 mph. Even so, we found these sounds far more stimulating than disturbing.

DRIVES AND PERFORMS NORMALLY

The reduction in response time means that this turbine car can be driven just like any automatic-transmission vehicle. "I don't even think about it any more," Huebner said as he maneuvered X7 through the downtown traffic of Washington, D. C., where Chrysler was showing the CR2A to the military. He uses a two-foot technique, braking with his left in the automatic-box manner, and doesn't hesitate to apply the brake to build gasifier rpm for a quick takeoff from a standstill or down a turnpike entry.

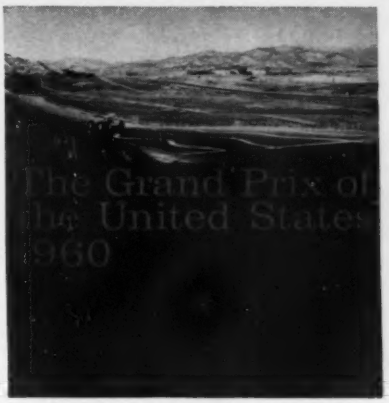
How's performance? X7 moves out about like a normal Plymouth at first, then steps forward like a powerpack job as speed mounts. This pioneering installation was made without sufficient time to adjust the transmission's shift speeds just right, so to avoid roughness the turbine was restricted to 92½ percent of its power peak speed. "It's too bad," Huebner said, "because it really gives you a kick in the back at the top end. Peak speed would give us another 25 horsepower."

Does the variable nozzle really produce engine braking? Yes, indeed. The intention with X7 was to provide braking that would be familiar to most passengers, rather than violent. Just enough vane movement is allowed to reproduce the deceleration of an automatic-box car in high gear, as we confirmed when riding in an ordinary Plymouth after X7. It's not arresting but it's far better than the headlong free-wheeling you get on a closed throttle in all other turbine cars. If more braking is desired, as might be applied through a four-wheel-drive layout, the vane movement can be increased.

PRICE STILL THE PROBLEM

Chrysler's CR2A turbine now performs fully as well as a piston engine, with far greater smoothness, less weight, and greater simplicity. We asked George Huebner if the latter fact meant it could compete with the piston engine on a price basis too. "Right from the start we realized that the turbine could never match the price of the reciprocating engine unless it was mass-produced in the same large quantities. For this reason we've concentrated on developing it for passenger car use. We haven't calculated cost figures on this new engine yet—and it's not possible to say anything definite until we've actually done so—but we believe that this turbine would cost no more than our present passenger-car engines, if it were completely tooled and produced in the same large numbers."

For these reasons, as many observers have noted, turbines aren't likely to be offered for sale in cars until they're tooled for very large quantities. Rover might confound this, by selling a small-production turbine car at relatively high cost, but it's not likely that Chrysler will take that tack. It's a shame that this is the case, because we find it hard to imagine a more exciting sports car than one using this CR2A turbine. —*KEL*



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ROAD RESEARCH REPORT: MASERATI 3500 GT

Continued from page 72

of their length and wet only over a small upper portion. On the two-liter engine these fit extremely tightly, with 0.004 inch interference. On the 3500 G.T. this was reduced to 0.0015 inch, and on the latest engine a very small O-ring rests in a groove in the sleeve half an inch from the bottom.

The top flange of the block was made thicker, next to the head joint, and a Silentbloc mounted at the rear was newly cast as part of the block. For the first time the crankshaft was fitted with a vibration damper, at the front end. To make room for this, the external racing-type oil pump had to be relocated. This job was simplified by adopting an Eaton Gerotor oil pump, smaller in overall dimensions than the gear-type pump it replaced.

Earlier the oil filter had been horizontal under the carbs, nearly impossible to service. It was moved to the back of the engine and placed vertically so it's easy to remove from the underside of the car. At the same time its inlet pipe — from the oil pump — was moved inside the engine, and its outlet made integral with the main oil gallery.

Oil may have tended to run warm before, on Italy's new superhighways, for the sump was given much deeper finning and a new oil circulating pump was fitted. This is a simple little fan-type pump, belt-driven at slightly faster than engine speed. It circulates oil from the sump through a cooler at the right of the water radiator, and sends it back to the sump again. In the manner of a centrifugal blower it pumps a lot more oil at higher revs than it does at low speeds.

Chain tension had always been applied by spring-loading the left-hand idler sprocket, but now that sprocket merely spins on an eccentrically-mounted shaft which can be rotated to achieve a certain amount of chain tension, then locked in place.

ENGINE BEHAVIOR TODAY

For all its development, the straight six as it came to our hands was powerful but truculent. Two hundred sixty horsepower (or 230 by CUNA standards) is mighty fine from 213 cubic inches. Specifically, it's 1.22 horses per cubic inch, 10% more than the fuel-injected Corvette's 1.11, a giant step ahead. But at the other end of the range, things aren't quite as smooth.

There are three big double-barreled Webers feeding the 3500. Not only are these carbs just about tops in getting maximum bhp at the top end, they are also famed for perking properly at medium and low revs as well. But in this case they weren't quite perfect. When you punch the pedal to the floor at or below 3000 rpm, the response is firm but lacking in smoothness. Above 3000 it both smooths out and strengthens, running right up to the factory-recommended limit of 5800 rpm.

It may have been that our test car was not perfectly carbureted. Not only was the engine rougher at low speeds than expected but we experienced unusual difficulty in exactly maintaining the various indicated speeds during the speedometer calibrations.

When just cruising along, the exhaust is silent and there is the merest trace of the traditional sewing-machine clatter of overhead camshaft engines. At no time is there evidence of any air hiss, the three Webers having their noses well buried in a giant air silencer and filter.

Exhaust noise is a different matter. Certainly no pretender to Bentley's fame and claim as The Silent Sports Car, the Maserati must at least be credited with sounding like a very dignified hot-rod. Though the accelerator pedal isn't the organ-type, it controls the noise output very accurately. Using a light right foot, the straight-six just murmurs along, even at highway speeds. But it's best to quote the Owner's Manual on this score, keeping in mind that even in Italy they have muffler laws. After making the point that the muffler system *has* passed the prescribed tests and *is* approved, they add:

"Nevertheless, every car, even though it bears the type approval stamp, is liable to exceed the limits set down by the regulation. This is because the engine at high revolutions while accelerating swiftly can exceed the legal limit. This is unavoidable if the car is to perform in accordance with the speed characteristics of this vehicle.

"We do not guarantee that this silencer will conform with the regulations laid down by the ministry, and do not guarantee that it will remain below the prescribed noise limit under all conditions of use."

FOUR SPEEDS, ALL SYNCHRO

The transmission is built by Z-F, and is the very same one used in the BMW 507. As we've said apropos the latter installation, the ratios, while not ideal for racing, are most satisfactory for a powerful, fast grand touring car. The relatively short first gear makes stop-and-go driving in the city as easy as in a boulevard-Corvette while the more closely spaced upper gears set you up for those great surges of passing power for highway maneuverability (or just plain showing off). Matching the three-five's arm's-out steering arrangement, the shift lever is ideally spotted where your right hand drops right onto it. The lever's a bit longer than on, say, most British sports cars and it's capped with a clean white plastic knob that fits the hand comfortably. There is just a trace of free play as you move it and then you sense a very mechanical feel (mechanical but well lubricated) as the precision-built synchromesh components start engaging with a gentle whir. Further movement engages the selected gear with little if any change in pressure and a definite sense of completion when the gear is "home."

To discourage you from resting your hand on the knob when you're actually staying in one gear, the lever transmits a slight hiss, perhaps from the shifting forks, when you move it to the limit of its free play in any of the gears.

With an engine well back in the frame (it hardly touches the front "axle" line), the gearbox is understandably well back in the cockpit. While it does separate the driver and passenger quite effectively from the knees down, ample width is left at the toeboards to wiggle your toes and find various positions to rest your feet. In fact the driver could well do with a revival of the "dead pedal" that was on the earlier cars for bracing himself in hard right turns.

CLUTCH AND FIFTH SPEED

The hydraulically operated clutch has long travel and very low forces. It is very smooth and easy, so much so that the importers were quick to assert that women could easily drive the Maserati in dense traffic without a care or a problem. While such a test is not part of our normal procedure, we judge this no exaggeration.

A car that looks as sporty as this is expected to be the fastest thing on wheels, especially at this price. But to be comfortable it's heavy and to handle well the engine is only modestly big. We hear from Europe that an available option is a five-speed gearbox with an overdrive fifth of 0.855 to one. Assuming its cost is within reason, we would heartily recommend it in conjunction with the 4.09 rear axle ratio. This would give noticeably better acceleration and the same quiet, economical low-engine-speed cruising. The car doesn't *need* five gears; it's got plenty of flexibility and poke for getting around in comfort and haste, but in this price stratum you can't afford to have the grocery boy beat you, can you?

ROOM FOR FOUR

A perennial problem for every designer of Grand Touring cars is whether or not to squeeze in a pair of jump seats. It's a situation where he's damned if he does and damned if he doesn't. If they're left out completely a good portion of his potential market just evaporates into thin air. If he jams them in, there's either too little legroom or too much wheelbase. Or both.

Once the designer's settled on having a back seat, he's only begun. How big should it be? How easy to get in and out of? Or see out of? The decisions in this case were evidently guided by the concept that to sell healthily, the Maserati 3500 G.T. should look as much like a racing G.T. as possible while still providing such homely virtues as could be fitted in.

Externally, the cabin structure is very brief in proportion to the body length it is very like a strictly two-seater, although a large one.

On the inside this puts the driver right up against the windshield while the occupants of the jump seat find (the hard way) that the rear window's metal trim strip is directly overhead. On the credit side, the rear seats are generously curved rather than thin, flat slabs more suited to carrying groceries than friends. To ease entry and exit, the front seats slide forward four or five inches as you tip their backs forward. That is, you push the whole seat forward rather than only the top part of the backrest. Under very hard, nearly panic braking, the occupant himself may slide forward. There should be some latch perhaps to prevent this.

COMFORT AND CONTROLS

The front seats are beautifully upholstered (black leather), handsomely curved individual seats. As well as having an extraordinarily large range of fore and aft adjustment, there is a small adjustment possible in the angle of the backrest which you get at while out of the car.

The left and right seats are not quite

identical. The passenger's has a modestly extended lip almost tangent to the transmission tunnel which presumably is to cater to those occasions when you get three people crowding in front.

As mentioned, the windshield is far back relative to the front seat; necessarily, so is the doorway and the doorpost. This makes getting in back easier, especially since the doorway is so wide. To improve the situation getting in the front seats, the cushions are three or four inches shorter than usual. This gives room to slip your feet past them without scuffing the leather, but everyone who drove missed having support under his thighs.

Making up for the seating position's shortcomings was the ease of using all the controls. The pendant pedals are well positioned and heel-and-toe downshifts can be made by braking with the ball of your foot, swinging your heel over to jab the large accelerator pedal. Though the latter is pendant too, your foot can be comfortably braced against the side of the gearbox for maintaining a steady speed.

GADGETS GALORE

One of the joys of $10,000 motor cars is that their manufacturers get delightfully extravagant with instruments and controls. There are 28 items listed in the dashboard diagram. Seven of them are warning lights, most of them are self-explanatory (once you've read the key) but the dipswitch/turn indicator needs elaboration.

As well as being a conventionally oriented turn signal lever, the former can be pulled or pushed to control the headlights. First you must pull the headlight knob out. It has two positions. The first gives parking or low beam, the second gives high or low beam and in either case the rather bright green warning light comes on. If the turn signal lever is flicked away from you, you get low beams. If it's more or less towards you, you get parking lights or high beams (according to how far out you've pulled the knob). If you're on high beam, you dip to low beam by flicking the lever away from you, later pulling it back when the oncoming cars have passed. There is also a spring-resisted position closer to you for this lever which will dip the lights until you let go, but it is more useful as a means of flashing your lights (low-beam) in warning when cruising at dusk on parking lights. To confuse the issue further, when you turn the fog-light switch on, you are in effect only substituting them for the low-beams. They are subject to all the same controls just described.

Once you get used to the complex system, it is easy to use but we would prefer a simpler system of operation at the cost of a more complex wiring diagram. This system and comment are equally applicable to all fast Italian cars; over there it is presumably the standard and they wouldn't want to change it.

The horn button, a little one in the middle of the wheel, sets off a surprisingly non-strident pair of trumpets which are amply loud for such a fast car without being raucous. This is admirable, as such an ostentatious car can be heartily disliked by fellow road-users in America if it is driven or sounded in a "me-first" manner.

(*Continued on page 92*)

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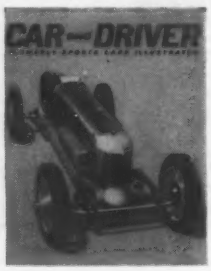

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(Continued from page 91)

The 3500 GT is not for boy-racers; it is a fast, elegant coupe for particular people to use for distinctive driving.

LUGGAGE ROOM

The large, light, lockable trunk lid is opened by pressing a button below it just above the bumper. If you keep your keys in a cluster, the only difficulty is in getting at the central keyhole. Inside is a wide, upholstered trunk with a very flat floor indeed. The largest part of it lifts up to expose the spare and the leather-wrapped tool kit which is so extensive that it ought to be kept under lock and key.

Behind a removable panel is hidden the 12-volt, 64 amp-hour battery. It couldn't be further from engine heat and earns a big credit in keeping the center of gravity near the center of the wheelbase.

Between a 21-gallon fuel tank and a spare 6.50 x 16 tire, the volume remaining for luggage stowage is much reduced from expectations, even with the fairly high level of the rear deck. Since rare indeed would be the owner who would tour long distances with four aboard, the deep-dished auxiliary seats can be used to carry additional luggage as well as all those odds and ends you like to have right at hand. A useful improvement would be the baggage strap tie-downs fitted to all Porsche coupes to ensure that it all stays put.

VIGNALE CONVERTIBLE

While we were putting the Touring-bodied coupe through its accelerative paces at Lime Rock, Connecticut, we were joined by Mike Garber who owns the Maserati Birdcage shown on the April cover. He arrived in his brand-new Vignale-bodied 3500 G.T. convertible which we also drove.

As the specs indicate, it has a four-inch shorter wheelbase. Though we had no opportunity to weigh it, we doubt it's appreciably lighter than the coupe. Even so, we found that in pressing it through Lime Rock's mile and a half of fast bends and esses, its shorter wheelbase gave it a definite edge over the coupe in nimbleness and, therefore, to our way of thinking, in desirability. The gain in responsiveness was not gained at any expense of stability so it seems all profit to us.

The trunk is noticeably shallower than the coupe's and the rear seat is sketchier. On the other hand, Vignale has thoughtfully provided electric windows with the switch for the passenger's side cleverly placed on the dash where either occupant can use it. The squeeze-up door handles are just under the large, well padded arm rests, leaving the door panel clear. The dashboard is completely different. There's no grab bar and while the instruments are grouped under a shroud, the controls are strung along a trimmed strip at the bottom of the dash. The glove compartment is much larger and can be locked.

The top, of course, goes up or down with that impeccable ease we have come to associate only with Italian and German convertibles. Coupes may be more practical, but convertibles are more fun any day—well, almost any day. Besides, it costs only eight percent more. What other brand can make that claim?

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(Continued on page 94)

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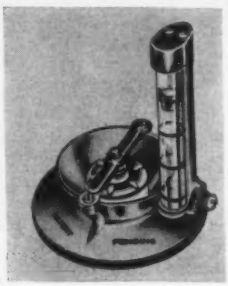

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(*Continued from page 92*)

istics, needing very much the same twist of the wheel at any cornering speed. Wheel forces remain steady at all speeds, even dead slow. The latter gives the initial impression that the coupe has heavy steering but this is only a static reflection of the heaviness of the car. At the higher speeds, it is very light steering for a car of this weight.

With sturdy anti-roll bars at front and rear the car stays very level even when you are pressing right to the limit. There is lots of power to play with and as you try taking particular bends at faster and faster speeds you find that the most comfortable technique is to turn the wheel more sharply than before as you approach the turn, which "rotates" the car, then feed some gas and pay off on the throttle enough to hold the car's attitude. Many cars which are called sports cars cannot be drifted but the Maserati 3500 G.T. with its years and years of racing car breeding, most certainly can. When the roadway and conditions encourage and permit such motoring, then all seems right in the world, especially the till-then strangely faraway position of the nearly-vertical steering wheel.

WIRE OR DISC?

The only option at all which is factory offered and factory installed without a special order is a set of Borrani wire wheels with knock-off hubcaps. The tab is a tidy $510, which doesn't sound like much when you're in the $11,000 bracket but certainly makes us pause. As well as cost, you have these factors: they're lovely to look at but difficult to clean—and the Maserati is the sort of sports car that just *has* to be kept in pristine condition. One solution is to corral at least two of those ever-present goggle-eyed small boys that seem to lurk in every neighborhood, supply them with worn-out toothbrushes and the other cleaning paraphernalia and put them to work. Federal wage minimums do not apply especially if, being yours, they are the reason you bought the Maserati and its small back seat.

As to beauty, our staff concurred that the standard steel disc wheels are the prettiest we've seen. As well as being easy to clean (or at least easier), disc wheels don't lose spokes and don't have to be "trued-up" after a few seasons. On the debit side, they are in this case mounted by four bolts rather than five and there are always going to be those infuriating types who want to know "How come it hasn't got wire wheels if you paid so much for it?"

DISC OR DRUM?

In wheels the question may be moot, whether to disc or not, but in the braking department there just isn't any question. The switch to 12-inch Girling discs at the front fulfills a shortcoming of the earliest 3500 G.T.s, as detailed in our November, 1958 road test. As is usual with largish cars, the heavy pedal pressure required for discs is ameliorated by an engine-vacuum-operated servo, successfully too, as the pressure isn't reduced to a ridiculous level. The brake pedal remains firm, a sensible compromise between the too-soft, for-ladies-only softness of conventional power braking and the racing-car-like stiffness of some of the less tractable high-performance sports cars.

(*Continued on page 96*)

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The Marquis de Portago with world champion Juan Manuel Fangio at the French Grand Prix.

Alfred Neubauer, Stirling Moss (right) and Denis Jenkinson after their 1955 Mille Miglia victory.

The Cooper team, left to right: Jack Brabham, Bruce McLaren, John Cooper.

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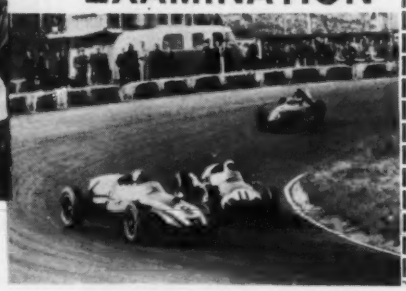

Moss (11) and Brabham (8) taking a corner at the Dutch G. P. Zandvoort

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(*Continued from page 94*)

The three-inch-wide drums of the same 12-inch diameter at the rear are unobtrusively effective; they never locked up under hard braking, even from 100 mph or so and also provide a strong parking brake. That same 100 mph braking never provoked a glimmer of fade during our fast lappery of the Lime Rock Park circuit. A trace of odor finally emerged, but the pedal was always smooth and positive.

SERVICING

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As to the Maserati parts themselves, they are mainly stocked in Glen Cove and Los Angeles and what other importer will give you the home phone number of his Parts Manager? (It's 516 ED 4-1216 and his name is Dan Ghelfi.) Actually, this was done for the benefit of people who race Maseratis, but it's a nice number to tuck in the glove compartment.

Routine maintenance looks to be quite simple and the especially enthusiastic owner could easily do much of the necessary work himself with the aid of the explicit manual. The latter includes about a dozen engineering drawings of such items as the engine, gearbox, rear axle, etc.

LIVING HIGH

No doubt about it, our favorite color for fast Italian cars is Italian racing red. What a pity our budget doesn't let us include a paint sample of this fierce bright color with each copy. Some might think a little modesty would be in order with such a flamboyant car but our attitude is if you're going to go, go all the way.

Helping to "carry" this color is the sculptured simplicity of Touring's steel body. It has no garish lines to snatch at your eyes, only this eye-stopping paint—and a plethora of visually exciting details: the 72-spoke wire wheels; the trident on the grille, borne so often and successfully by the firm's racing cars; the wood-rimmed steering wheel; Carrozzeria Touring's "Superleggera" script proudly mounted on both sides of the hood; the repeated use of the red, blue and silver Maserati trademark, especially in miniature, lapel-pin-size on the ashtrays and dashboard; the precise functional way the aluminum-trimmed window sill is relieved to clear the pivoting wind-wing and the way the round padded grab bar is integrated into the dashboard.

No car of this sort will be perfect for everybody, but every one of them is exciting to examine and, if it's perfection for you, what pleasure to anticipate and especially to own! —*C/D*

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PROJECT TIME MACHINE: THE ENGINE

Continued from page 81

and valve gear reciprocating weight it carried certain benefits: the most compact surface for a given volume; minimal heat rejection to coolant; the possibility of machining combustion chambers thoroughly to precisely identical capacities. With the pent-roof layout only the valve seats could be machined with accuracy.

The first 122s had a bore and stroke of 2 11/32 by 3½ inches, ran 7.5 to one compression ratios as a rule and developed a good 120 bhp at 5000 rpm. However, they commonly were wound as tight as 6500 rpm (equal to a corrected piston speed of 3100 ft./min.) Between 25 and 30 122s were built. Delco distributor ignition was used on a few early ones. Magnetos driven off the rear of the camshafts were abandoned because torsion of the shaft caused variations in timing. Finally the right-angle mag drive was settled upon which still is used on the Offy. Again the ball rear main bearings were quickly replaced by poured bearings. Only two or three 122s were supercharged. The fuel used was still gasoline but during this period tetraethyl lead was introduced and generally was used in a ratio of about two cc per gallon. The complete engine weighed only 303 pounds.

STILL SMALLER AND BETTER

The 122-cubic-inch Formula had failed to create slower racing and was superceded by a 91-cubic-inch limit on displacement in 1926. Supercharging (to be covered in detail in a future Time Machine installment) had made its American debut in 1924 but was too new, too experimental, to be regarded as a factor in the new Formula. For this class of competition Miller produced the immortal 91, the most refined and efficient of his eights.

Just as the 122 was an improved and scaled-down 183, so the 91 was a better, smaller version of the 122. A major change was that, while the blown 122s had their centrifugal superchargers driven off their camshafts as an afterthought the 91 was designed from scratch as a blown engine. The blower was driven by a train of gears at the flywheel end of the crankshaft and the engines ($5000, FOB Los Angeles) were delivered with blowers unless otherwise specified. Because the blowers were definitely troublesome a number of engines were ordered unblown, in which case they were equipped with the by-then-familiar four twin-throat Miller carbs. The superior Winfields replaced these toward the end of the Formula.

The Miller 91 was sensationally successful both in automobile and boat racing. Running on gasoline in 1926 Frank Lockhart drove a rear-drive Miller 91 171 mph one way and 164 mph two ways, according to AAA timing. At this time the 2 3/16 by three inch engine ran a compression ratio of 5.35 to one and delivered the following outputs:

(Continued on page 98)

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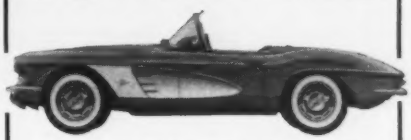

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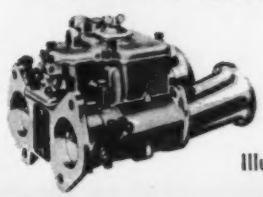

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ART CENTER SCHOOL

(*Continued from page 97*)

rpm	bhp
5500	118
6000	136
6500	150
7000	154

Lockhart was the first to add an intercooler to this engine's induction system and Leon Duray was the first to develop its use of methanol fuel. Lockhart developed an annealing technique to cure the engine's congenital disposition to valve-stem breakage. He also developed oversize con rods which were not prone to be split by the wrist pin like kindling wood as ever higher outputs were extracted from the 91. Most of these improvements and many similar ones were picked up by the users of the approximately 50 91s that were built by Miller. Toward the end of the Formula Duray was running a nine to one mechanical compression ratio which, with blower boost, calculates out to an effective overall c.r. of 15 to one. From this engine he allegedly pulled 265 to 280 bhp at 8000 rpm. This is on the high side, perhaps, but 230 bhp was easy to extract from any good 91. Corrected piston speed at 8000 rpm was 3415 ft./min. but some of the hotter machines would wind out to 8500 rpm.

IT WAS RELIABLE TOO

The 91 achieved a high degree of reliability, which is remarkable in view of the output for which it was originally designed. Miller was known never to have criticized an employee for making a part too light but to have fired many for making parts too heavy. The 91 engine, complete with blower, inlet manifold and carb, but without magneto, weighed 292 pounds.

The tiny aluminum crankcase was pure filigree and very thin-walled at that. It had little strength of its own and it was debated whether the case would have any significant stiffness if it were not for the crank and main bearing assembly which it carried. The first 91s had small, light, cast aluminum covers for the crankcase hand holes. To stiffen the case Miller adopted thick, heavy, deeply ribbed side plates. These were not strong enough for many racing men in the field who used quarter-inch boiler plate instead. And the case itself was steadily beefed up by Miller by shaving wood off the pattern cores until the wall thickness was increased by over 100 percent.

Some of the crankcase's modest stiffness (and this applies to Miller-breed engines from the 183 to the current Offy) is due to the heavy, bronze, 360-degree main-bearing webs. These are assembled to the crank, which is then slid into the case from the flywheel end. Each web has a cylindrical surface which spigots into the crankcase bulkheads, to which it then is bolted. There is an interference fit of about 0.002 inch between web and case, so that the case must be heated a couple of hundred degrees F. for assembly to be made. When the case cools the entire assembly is very tight and rigid but the value of the interference fit is probably lost when the engine reaches normal operating temperatures.

Evidence of Miller's passion for economy (not in the monetary sense) in design is the fact that the crankshaft counterweights clear the main-web retaining nuts by only about 0.03 inch. This efficient precision was consistent throughout the engine and of course contributed to its high cost.

THE END OF AN ERA

Says Fred Offenhauser, "Miller demanded perfect workmanship and materials had to be the best available. He didn't want to see machine or file marks. All castings had to be hand-scraped and polished to a satin finish. The engines looked like jewels. He could have made a lot more money if he hadn't cared so much about finish but he didn't think that way. It took from 6000 to 6500 man-hours to build a car, of which 700 to 1000 hours went into beautifying the machine. About half of those man-hours went into the engine and transmission."

Says Ed Winfield, "Miller was *the* originator, in the automotive field, of doing an artistic job on his machinery; he was more of an artist than an engineer. The one thing that he insisted on—and that was pure Miller influence—was having everything well proportioned and well finished, regardless of reliability."

Says race-car engineering veteran Eddie Offutt, "The terrific performance and economy from the 91 had people clamoring for the same efficiency from the passenger car industry, which helped to kill it. The end of the 91-inch Formula was the end of the golden age of American racing machinery. The junk element came in and, with it, the racing of drivers instead of cars." —*GB*

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